REPORT

OF

The Syllabus Committee

on

Training of Rural Artisans

in the

Community Development Blocks

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PART II

Vol. I

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MINISTRY OF COMMUNITY DEVELOPMENT & CO-OPERATI
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PREFACE TO PART II OF THE REPORT

The Syllabus Committee on the training of rural artisans in the Community Development Blocks submitted its report consisting of two parts *viz.* Part I and Part II. In Part I of the report, the findings and recommendations of the Committee for improvement of the training programme have been incorporated.

Part II contains the syllabii on 23 trades recommended by the Committee for the training of rural artisans. Vol. I, II, and III of Part II of the report contain these syllabii as noted below :—

Vol. I

1. Hand Spinning including Amber charkha and weaving of Khadi (Cotton).
2. Hand spinning of wool and weaving of Khadi Woollens.
3. Hand Made Paper making.
4. Hand Pounding of Paddy and processing of other Cereals.
5. Bee Keeping.
6. Fibre Industry including Brush making Coir work.
7. Gur and Khandsari making.
8. Palm Gur making.
9. Soap making from non-edible oils.
10. Crushing of Oil Seeds—Village Ghanis.
11. Flaying, bone digesting and tanning of leather.

Vol. II

1. Wooden toys and allied crafts (lacquer ware).
2. Fruit and Vegetable Preservation.
3. Cane and Bamboo works.
4. Bricks and Tiles making.
5. Bakery and Confectionery.
6. Hosiery and Hand knitting.
7. Mat weaving.

Vol. III

1. Manufacture of leather goods.
2. Tailoring-cum-embroidery and cloth doll making.
3. Carpentry including polishing and painting as related to carpentry.
4. Carpentry including polishing and painting for upgrading the skill of rural artisans.
5. Village Pottery Industry.
6. Textile Dyeing and Printing.

HAND SPINNING INCLUDING AMBAR CHARKHA SPINNING AND WEAVING OF KHADI (COTTON)

(RURAL SYLLABUS COURSES, IN KHADI AND CORPS AMBAR SPINNING AND WEAVING).

Scope of training :

The primary object of the programme of Khadi and Ambar Charkha is to provide part-time and additional employment to the underemployed and unemployed. The internal consumption of cloth in the country taking on an average of 17 yards per year per capita is over 6,000 million yards. The total production of khadi including Ambar Khadi is about 50 million yards which is less than 1 per cent of the total requirements of the country. The consumption of cloth by the end of the Second Five-Year Plan period is expected to increase by about 25 per cent over the consumption at the end of the First FiveYear Plan and a substantial portion of requirements of yarn for increased production of cloth is expected to come from spinning on traditional charkha and also from Ambar Charkha and thus provide employment to large number of workers which is the urgent need of the day. Since cloth is one of the three primary needs of life, there is a market in every block and every home and, therefore, this programme should be taken up in all blocks. This is an industry which can be taken up by farmers as a part-time employment as well as those who are unemployed as full-time job. Women and children could also actively take up this industry. There is no other industry which has a larger uniform scope for development in the rural Weaving.)

Hand Spinning and Weaving of Cotton

AMBAR WEAVING COURSE (*Curriculum*)

(1) *Admission*: Admission is restricted to weavers who can read and write well and hereditary can weave 10 to 12 yards of cloth on 20s count of yarn or 9 to 10 yards of cloth of 32s to 40s count of yarn working 8 hours per day as far as possible.

(2) *Duration of Training* (three months) :

Total days	90
Sundays and holidays	5
Working days	75
Daily working hours	8
Total working hours	600

(3) *Distribution of hours* :

Practical	525 hours
Theory	75 ,,

Syllabus of Training

(IIA) *Practical work* :

(1) Opening and winding of yarn :—

(a) On pirns for weft

(b) On flanged bobbins for warp

(2) Warp making :—

(a) Ball warp

(b) Warp on beam.

(3) Size mixture making :—

(4) Sizing of yarn :—

(a) Hank sizing

(b) Brush sizing.

(5) Drawing or Denting and Piecing (joining).

(6) Designing and Dobby work.

(7) *Weaving* :—

(a) On pit loom of fly shuttle.

(b) On pit loom of take up motion

(c) Frame loom with take up motion

(d) Peddle loom or automatic loom.

(8) Fitting of looms.

(IIB) *Theoretical lessons* :

(1) Preliminary information of cotton, staple length of cotton, cotton mixing etc.

(2) Difference between traditional yarn spinning, Ambar yarn spinning and mill yarn spinning.

(3) Testing of twist in yarn.

(4) Testing of Tensile strength of yarn.

(5) Yarn calculations :—

(a) Weight of warp

(b) Weight of weft.

(6) To find out by calculation the course of yarn used in fabric.

(7) Estimating and costing of yarn.

(8) Costing of cloth.

(9) Information regarding texture of cloth, cloth examination probable defects in cloth and ways to avoid them.

(10) Information regarding folding, finishing and packing of cloth for better appearance.

(11) Information regarding Khadi production and sales in India. Principal Khadi Weaving Centres in India.

(12) General lectures on 'Why Khadi is preferable to Mill cloth.'

(13) Testing of cloth.

Schedule of Training

A.1) *Practical working programme* :

Job Desirable standard of skill to be achieved	Outturn of work per day	Days	Hours
Weft pirns			
Weft pirns filling ..	50 gundies	4	28
Warp bobbins filling ..	49 ,,	4	28
Ball warp making ..	5 tanis	4	28
Beam making	2 beams of 100 yards a pair of students.	4	28
Size mixture making ..		1	7
Hank sizing	500 gunies	3	21
Brush sizing	1,600 ends of 100 yards two sets per pair of students.	4	28
Drawing	2 beams of 1,600 ends by a pair of students.	3	21
Piecing or joining ..	1 beam	3	21
Design making .. Dobby fitting – ..	2 Designs 1 Dobby	6	42

(IIIA.2) *Weaving : Desirable standard of skill to be achieved.*

Job	Outturn of work per day	Days	Hours
	Shirting 15 yds H. Comb. 9-P Towels 30″ of Coating 1½ ds.		
(A) Pit fly shuttle loom	5 yds. 4 pieces 4 yds.	6	42
(B) Pit fly shuttle take up loom.	7 yds. 6 pieces 6 yds.	7	49
(C) Frame fly shuttle take up loom.	8 yds. 8 pieces 8 yds.	12	84
(D) Peddle/ Automatic loom	10 yds. 10 pieces 10 yds.	12	84
Loom Fitting	One loom by a pair of students.	2	14

(IIIB) *Theoretical training*

(1) Preliminary information of cotton, staple length of cotton, cotton mixing etc.	7
(2) Difference between traditional yarn spinning, Ambar yarn spinning and Mill yarn spinning.	7
(3) Testing of twist in yarn	4
(4) Testing of Tensile strength of yarn	4
(5) Yarn calculations	7
(6) To find out by calculation the counts of yarn used in a fabric ..	7
(7) Estimating and costing of yarn	7
(8) Costing of cloth	7
(9) Information regarding texture of cloth or cloth, examination, probable defects in cloth and ways to avoid them.	7
(10) Information regarding folding, finishing and packing of cloth for better appearance.	3
(11) Information regarding Khadi Production and sales in India. Principal Khadi weaving centres in India.	7
(12) General lectures on 'Why Khadi is preferable to Mill cloth'	4
(13) Testing of cloth	4
GRAND TOTAL ..	600

IV. The test in each trade will be taken after completion of the training. The respective job must be completed within the specified time in the above schedule.

Accuracy in work and production with a minimum time will be a point of merit.

V. *Quarterly Expenditure for the Scheme Ambar Cloth Weaving Course*

	Rs.
(1) Stipend to weavers at Rs. 75 p.m. × 10 students for three months	2,250·00
(2) Tuition fees at Rs. 15 p.m. x 10 students for three months ..	450·00
(3) Rent Rs. 50 p.m. for three months	150·00
(4) Contingencies Rs. 25 p.m. for three months	75·00
(5) Coolie (one @ Rs. 40 p.m. for three months)	120·00
(6) Fitter or jobber @ Rs. 100 p.m. for three months	300·00
(7) Clerk (one) @ Rs. 75 p.m. for three months	225·00
(Rs. three thousand five hundred and seventy only).	3,570·00
Cost of equipments ..	4,856·56
GRAND TOTAL ..	8,426·56

SPINNING OF WOOL AND WEAVING OF KHADI WOOLLENS
SYLLABUS
(Theoretical and Practical)

I. *Wool.*

(1) Knowledge of different classes of Textile fibres, both natural and man-made and Wool in particular. Chemical and physical properties of Wool fibre.

(2) Difference between Wool and hair.

(3) What are dead fibres?

(4) Milling properties of Wool and hair.

(5) Differentiation between Shinned wool and Virgin Wool.

(6) Production of Wool in India and its seasons; (A) Kashmir, (B) Tibet, (C) Rajasthan, (D) Deccan.

(7) Production of Wool in foreign countries and its seasons.

(8) Sorting and grading of Wool.

(9) Scouring of Wool and knowledge about different impurities present in Wool and the loss in the Wool caused thereby.

(10) A short history of the attempts made in India of improving the breeding of Sheep and Wool and also of development of Wool in foreign countries.

(11) Methods of adulteration made in Virgin Wool.

II. *Carding and Spinning of Wool* (Theory and Practice)

(A) *CARDING*

(1) Objects of carding.

(2) Methods of mixing other fibres along with Wool and care to be taken in carding.

(3) Different methods of carding such as Bow, Pinjan, Card brushes, Dhunai Modhia or Pedal machine.

(4) Short knowledge of machine carding.

(B) *SPINNING*

(1) Count of Woollen and worsted yarn

(2) Amount of twist to be put in the yarn and its milling property. Twist in the warp and weft yarn.

(3) Characteristics of Woollen and worsted yarn vis-a-vis other yarns.

(4) Doubling of yarn and calculation of resultant counts.

(5) Different systems of counting other yarns such as Cotton, Silk, Rayon and Jute, etc.

(6) Different types of implements used in Wool spinning such as Takli Pedal Charkha (Flyer & Bobbin), Rani Charkha (Ring Spinning), and Bardoli or Khada Charkha.

III. *Preparatory processes and Weaving* (Theory and Practice).

(1) Objects of preparatory process.
(2) Winding for warp and weft.
(3) Warping. Different methods of warping such as, (A) Ped, (B) Sectional, (C) Beam, etc.
(4) Object of sizing and materials used in sizing.
(5) Sizing—Hand sizing, Sheet sizing and sizing in Sections.
(6) Drafting and denting healds and reed and calculations.
(7) Different types of Looms used in Weaving.
(8) Important motions in the working of Looms.
(9) Different settings used in Woollen and worsted cloth.
(10) Calculations of warp and weft in cloth.
(11) Analysis of finished cloth and its reproduction.

IV. *Dyeing and Finishing* (Theory and Practice)

(1) General knowledge about the dyeing Methods of dyeing Wool in acid, Chrome and union colours.
(2) Object of Milling and raising.
(3) Foot milling and machine milling.
(4) Different materials used in milling.
(5) Behaviour of different cloths in milling process.
(6) Raising by brush.
(7) Drying and Kundi.
(8) A short note of finishing by machinery.

V. *Costing.*

(1) Cost of Wool (due allowance to be made for the losses).
(2) Cost of carding (due allowance to be made for the losses).
(3) Cost of spinning (due allowance to be made for the losses).
(4) Cost of warping (due allowance to be made for the losses).
(5) Cost of sizing.
(6) Cost of weaving including pirn winding.
(7) Cost of milling and materials used.
(8) Cost of Raising.
(9) Cost of finishing.
(10) Margin of profit to cover all other expenses.

VI. *General.*

(1) Knowledge of cooperative law.
(2) Instructions in cooperative accountancy.
(3) Preparation of trading account, profit and loss account and Balance Sheet.

HAND MADE PAPER MAKING

Preamble

Present per capita consumption of paper in India is only 1.9 lbs. per year. Of the total population of 370 millions, only about 18 per cent are at present literate. The per capita consumption of paper is bound to rise with the spread of literacy. The expansion of the mill-made paper industry is limited due to several factors.

The hand-made paper industry, however, can be started anywhere for the following reasons :

1. raw materials locally available in small quantities can be utilised; (there are about 200 kinds of raw materials useful for pulp);
2. the machinery equipment can be manufactured by small workshops even in towns and villages;
3. labour is abundantly available in villages and small towns;
4. an ordinary trained labour can manufacture good quality of all sorts of paper;
5. centres can be started with small quantity of water and electricity or oil engine, or bullock power available locally;
6. per capita investment is very small, i.e., about 1,500 while in mill industry it is not less than Rs. 20,000;
7. the industry can provide employment to thousands of people; and
8. the scope for the hand-made paper industry in the country is enormous.

The present backward condition of the hand-made paper industry may largely be attributed to the absence of facilities to carry out improvements in the manufacturing techniques. If this aspect of the industry is given sufficient attention the industry can be developed to meet a substantial portion of the domestic demand for paper and provide employment to a large number of persons.

Object

The main purpose in imparting this training to the Artisans (i.e. old workers) in Handmade Paper Industry, is to acquaint them fully with the various processes of handmade paper manufacture of general and high grade quality. The training will enable the artisans to specialise in several important and complicated processes, (like beating,/putting, lifting, couching and glue sizing, calendering, cutting, etc. requiring constant attention of the highly skilled artisans) for increased output and better quality. Hence, much emphasis has been laid on the practical side, so that each artisan, after completion of his training, will become specialised for a specific process.

The syllabus for trainees, who are new to the subject is enclosed herewith. The hereditary artisans, (who are already in the industry for years together), require a sort of refresher's course for learning manufacture of hand made paper on modern lines, or upgrading their existing skill. They may be admitted for few weeks course at stages necessary for upgrading their skill according to local conditions.

The machinery and equipment for manufacture of handmade paper are so designed that in the absence of electric power, they may be run by oil engines.

As the training is meant for artisans (who are mostly illiterate), formal lectures, say thrice a week, may be held. However, their practical training will always be coupled with theoretical instructions, when they are at actual practical work.

The manufacture of handmade paper and particularly high grade paper, involves many chemical and mechanical processes, besides everyday handling of many chemicals. These facts are to be impressed upon the artisans.

SYLLABUS FOR RURAL-ARTISANS' COURSE—HAND MADE PAPER MAKING

(Duration of the Course : 6 months)

Sl. No. Topic (1)	Practical (2)	Theory (3)
1. Study of various plants, etc., containing fibre yielding raw materials useful to Handmade Paper Industry; sources and characteristics of raw materials.	Practical study of the part of the plant, containing the fibrous materials—observation— separation of the raw materials from the plant.	(1) Definition of terms and brief history of paper (2) Study of different plants,containing fibre-yielding raw materials; like waste paper grasses (Bagasse Straw, Jute) Rags and/or cotton waste etc. (3) Availability, collection and transportation (where necessary) of those materials.
2. Preliminary treatment of raw materials—		
(a) Cleaning	Separation of dirt, dust & other impurities from the raw materials.	
(b) Sorting	Sorting of the mixed raw materials into different colours.	
(c) Cutting	Cutting of the cleaned and sorted raw materials to the required length, making suitable for further processes.	
3. Chemical treatment	(1) Soaking, retting, boiling, cooking, or digestion, bleaching, etc.	(1) Study of the properties, and uses of various chemicals, like caustic soda, soda ash, lime, bleaching agents etc. required for the Industry-Mixing of these chemicals in proper ratios and precautions to be observed while mixing and in use.
	(2) Different treatment for different raw materials.	(2) Implements/equipments like soaking tanks, open pressured digestors, etc. required for the various processes
	(3) Washing by old methods and by washing drum (in the Beater).	(3) Importance of washing before giving subsequent chemical processing.
	(4) Preparation of bleaching solution and models of bleaching—Antichlores like sodium bisulphate, etc. used to destroy the remaining traces of chlorine.	(4) Qualities, and properties of the chemically treated products and their test checks.

Syllabus for Rural-Artisans' Course—***Hand Made Paper Making***—contd.

(1)	(2)	(3)
4. Beating	(1) Beating of various raw materials, (waste paper, grasses, rags, etc.)	(1) Stepwise development in the process of beating from old methods (trampling, dhenki, etc.) to Hollander—beater.
	(2) Beating for different varieties of hand-made paper, like utility, blotting, file & boards, air mail, tissue, bond, drawing, etc.	(2) Study of Hollander—Beater/its—various parts and their functions—construction of a beater-trough.
	(3) Initial stages of beating—process of bleaching and use of anti-cholres washing.	(3) Mechanism of beating—controlling factors for effective beating.
	(4) Addition of Rosin soap, alum, loading materials (Starch, China-clay, titanium dioxide, etc.). Their approximate proportions (depending upon the quality of paper to be produced) & order of addition—Due preference.	(4) Theory and purpose of sizing—old methods of sizing by starch.
	(5) Preparation of Rosin Soap (Size)	(5) Engine (Beater or Rosin) sizing and tub (surface or glue) sizing. Their purpose and methods of application Chemical Rosin, Washing soda, or caustic soda, water/Glue, Alum, Neutral Soap. Tinopal, etc.) used here, their properties and percentages.
	(6) Addition of Broke and its purpose	(6) Loading materials or fillers starch, china clay, titanium dioxide, etc.). Their purpose properties and proportions used—method and order of addition.
		(7) Use of colouring matter/shade matching/use of Indigo and tinopal.
5. Lifting and Couching	(1) Actual process of lifting—Lifting by hand (with wire mesh moulds) or by improved vats (vico., Poona vats, etc.)—Due precautions.	(1) Different types of paper lifting moulds, like grass mats and frames, wire-mesh moulds, woven moulds & laid wire moulds.

	(2) System of couching and due precautions—use of cloth/felt. (3) Adjusting the weight of sheet (*i. e.* substance of ream). (4) Defective sheet formation by water drops air-bubbles, etc.--Their causes and remedies.	(2) Principles of sheet formation/ importance of shake and levelling. (3) Methods of water-marking.
6. Pressing of Paper	(1) Actual process of pressing & due precautions. (2) Separation of wet sheets from cloth/ felt and due precautions.	(1) Purpose and different modes of pressing, equipment used like screw—press. (2) Importance of uniform pressure on the quality and texture of the sheet.
7. Paper Drying	(1) Actual process of drying and due precautions. (2) Drying in direct sun light—its advantages and disadvantages. (3) Loft-drying and its advantages over the other methods. (4) Brushing and cleaning of the dried sheets.	(1) Different modes of drying the sheets, smooth surface, wall, wooden stand and metal sheets, etc.—their relative merits and demerits.
8. Tub (Surface glue) sizing	(1) Applicable to high grade papers only. (2) Preparation of glue size—chemicals used, (glue, alum, special soap, etc.). Their properties and percentages. (3) Mode of application of the sizing and appliances used. (4) Precautions to be observed while and soon after, the glue sizing.	(1) Purpose—types of papers requiring the sizing starch and glue sizing.
9. Glazing or Calendering	(1) Actual process of calendering and due precautions. (2) Production of different finishes on different varieties of paper. (3) Due precautions while calendering (4) Defects in calendering and their remedies.	(1) Purpose of calendering implements/ machines required for calendering. (2) Study of calendering machine and its part including reversible arrangement and spring levering. (3) Care and maintenance of the machine. (4) Importance of metal sheets used—their advantages and disadvantages.

Syllabus for Rural Artisans' Course—Hand Made Paper Making—concld.

(1)	(2)	(3)
10. Paper sorting, cutting and packing, stationery making.	(1) Actual process of sorting *i.e.* separation of good sheets from the damaged ones. (2) Use of damaged sheets, cutting sheets in small sizes for use in stationery making—reduction in wastage. (3) Methods of cutting and appliances used. (4) Methods of packing the cut sheets and transportation.	(1) Standard sizes of paper of different varieties and their substances. (2) Defects in paper, their causes and remedies. (3) Difference between Hand made Paper and mill-made paper.

List of Machinery & Equipment

A. Machinery

	Rs.
1. Oil engine 22 H.P. ..	8,500
2. Vomitting type of digester 30" diameter and 40" width ..	1,300
3. One beater with 30 % dia, 24" wide roll ..	6,200
4. Screw press with 36" × 42" platen ..	4,500
5. Calender machine ..	4,000
6. Cutting machine ..	3,000
7. Shafting accessories ..	500
8. Poona vats 2 ..	1,600
	29,600

B. Equipment

1. Spring balance 200 lbs ..	75·00
2. Chain pulley block ..	500·00
3. Wheel barrow ..	100·00
4. Emery grinder ..	100·00
5. Storage vat ..	200·00
6. 2 Couching tables ..	100·00
7. 10 Press boards ..	300·00
8. Paper lifting moulds four pairs ..	660·00
9. 2 towel horses ..	40·40
10. Sizing trays 2 ..	100·00
11. Stools 6 ..	90·90
12. Drying stands 25 ..	1,250·00
13. Set of tools ..	150·00
14. Knives, sizing, vessel, hosepipe, bucket ..	200·00
	3,866·30

HAND POUNDING OF PADDY AND PROCESSING OF OTHER CEREALS

Preamble

Rice is the most important cereal in India accounting for 35.8 per cent of the area under cereals and 44.6 per cent of their total output. According to the report of the Nutrition and Research Laboratories, rice is the staple food for over 70 per cent of the population of India. Consequently, any measure that improves the quality of rice or augments its availability is of vital economic and nutritional importance. The development of the hand-pounding industry in India has, therefore, a three-fold significance :

(1) It can provide employment on a large scale, particularly to women in the rural areas for 150 days in a year on an average;

(2) It can augment the availability of rice by higher percentage of recovery from paddy; and

(3) It can supply rice which is rich in food values and thus contributes to the improvement of the health of the population.

HAND POUNDING OF PADDY AND PROCESSING OF OTHER CEREALS

SYLLABUS

I. Object

Hand pounding industry is one of the traditional village industries of India. Before Khadi and Village Industries Commission took up this industry in its programme, Hand pounding industry was carried on by the professionals with the traditional implements available at that time. The quantum of yield by these implements was small and young persons employed in this industry were compelled to leave it for reasons of low return. Subsequently it was thought that if the improved types of implements and proper guidance were given to the hand pounding professionals in running this industry, it could flourish very well. Besides, this industry offers a vast scope for employment if the hand pounded rice is popularised among the general masses by the trained personnel by impressing upon them the nutritive value of hand pounded rice.

With these objects in view, the personnel for taking up the work were required to be trained. The aim is to give training to the artisans in the use of improved implements and improved processes like par-boiling, grading dehusking, winnowing, separating, polishing and preservation with a view to increase their efficiency of production, organizational and commercial aspects of the trade are also required to be dealt with.

(1) The syllabus is meant for those who are new to the subject and for upgrading the skill of the existing hand pounding workers.

(2) *Duration* :

Duration of the training course is 6 weeks. Training may be conducted by mobile training units.

(3) *No. of trainees* :

15 trainees per each Instructor in each course.

(4) *Persons to be trained* :

The traditional female artisans and distressed women are to be preferred for the training.

(5) *Qualification* :

No educational background is necessary.

SYLLABUS FOR HAND POUNDING OF PADDY AND PROCESSING OF OTHER CEREALS

(Duration of the Course—6 weeks to suit paddy harvesting season)

Hand Pounding of Paddy

Topic	Practical	Theory
1. Varieties/Qualities of Paddy	Visiting an Agricultural Exhibition or permanent Agricultural museum.	1. Study of different varieties and qualities of paddy. 2. Yield of rice from paddy. 3. Market value.
2. Par-boiling	Par-boiling processes.	1. Importance of Recovery and Nutritive value. 2. Importance of proper boiling and drying of paddy.
3. Processing of Paddy—		
(*a*) Grading	To separate dirt from paddy and grading the given quantities of paddy with the help of sieves and graders.	Advantages of grading paddy.
(*b*) Dehusking	To dehusk the graded paddy in chakki or pestle and mortar or dhenkies.	Study of the recovery and dehusking capacity of different equipments. To determine the capacity in cases of different varieties of paddy.
(*c*) Winnowing	Use of paddy dehusking implements, their adjustment and mechanism. Winnowing husk from dehusked paddy by winnowing fan, and cloth or wooden winnower.	Loss in the Recovery of raw rice in winnowing by operating the fan speedily.
(*d*) Separating	Methods of sieving. Separating paddy and from the winnowed rice with sieves of different meshes.	
(*e*) Polishing	Polishing raw rice with pestle & mortar and dhenki.	Different Grades of polishing. Importance of polishing.
(*f*) Use of rice and its products		Technique of cooking handpounded rice. Use of rice and its different preparations Use of husk and rice bran.

5. Preservation of hand pounded rice	Various methods of preserving hand pounded Rice.	Economic value of preservation.
6. Organisation	—	Organisation and working of Industrial Cooperative Society and registered institution. Membership of the Indl. Coop. Society. Advantages of forming an Industrial Cooperative and responsibilities of members. Marketing of Hand pounded rice.
7. General	—	Advantages of Hand pounding Industry with special reference to employment, capital, investment, wages etc. Scope of development accordingly to the programme of Khadi and village Industries Commission. Assistance available to the Hand Pounding Industry. Economic Unit.

THE IMPLEMENTS USED FOR HAND POUNDING OF PADDY AND PROCESSING OF OTHER CEREALS, THEIR SOURCES OF AVAILABILITY AND PROCEDURE TO OBTAIN THEM. NAMES OF MANUFACTURERS, PRICES HOW AND TO WHOM TO SEND MONEY AND ADDRESS CORRESPONDENCE ETC.

Sl. No.	Name of the Manufacturer	Price	Subsidy Granted by the commission	Amount to be paid by the purchaser	To whom to address the correspondence	To whom and how to send the subsidized cost of implements required
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Stone Chakkis (For Paddy dehusking):—						
	Chakkis are manufactured by the following parties in different States and can be had from them at the prices shown against them:—					
1.	Cooperative Cottage Industries Ltd., Tumkın (Mysore State).	Rs. 30/- each F.O.R. Tumkur.	Rs. 15/- each	Rs. 15/- each	The Development Officer Hand-Pounding Industry, Arya Bhavan, Tumkur (Mysore State).	To the Development Officer, Hand Pounding Industry (Mysore State), Arya Bhavan, Tumkur by M.O. or draft drawn in favour of "Co-operative Cottage Industries Ltd." Tumkur.
2.	Gandhi Ashram Mirzapur (U.P.).	Rs. 26/- each F.O.R. Destination Stn.	Rs. 13/- each	Rs. 13/- each	Secretary, Gandhi Ashram, Mirzapur (U.P.).	To the Secretary, Gandhi Ashram, Mirzapur (U.P.) by M.O. or draft drawn in favour of the Secretary, Gandhi Ashram, Mirzapur.
3.	Bihar Khadi Gramodyog Sangh, Muzaffarpur (Bihar).	Rs. 30/- F.O.R. Destination Stn.	Rs. 15/- each	Rs. 15/- each	The Secretary, Bihar Khadi Gramodyog Sangh, Muzaffarpur (Bihar).	To the Secretary, Bihar Khadi Gramodyog Sangh, Muzaffarpur M. O. or draft drawn in his favour.
Dhenkis for Polishing Rice						
1.	Kaira Distt. Industrial Co-operative Association, Nadiad, Distt. Kaira.	Rs. 50/- each F.O.R. Nadiad.	Rs. 25/- each	Rs. 25/- each	The Member-in-charge, Hand-Pounding of Rice Industry, Patel Hall, Nadiad, Dist. Kaira.	To Khadi & village Industries commission by M.O. or draft drawn in favour of the Kaira Dist. Industrial Cooperative Association, Nadiad.
2.	Cooperative Cottage Industries Ltd., Tumkur (Mysore State).	Rs. 40/- each F.O.R. Tumkur.	Rs. 20/- each	Rs. 20/- each	The Development Officer, Hand Pounding Industry, Arya Bhavan, Tumkur (Mysore State).	To the Development Officer, Hand Pounding Industry (Mysore State) Tumkur by M. O. or draft drawn in favour of the Secy., Co-

					operative Cottage Industries Ltd., Tumkur.
3. The Research Institute Maganwadi, Wardha,	Rs. 35/- each F.O.R. Wardha.	Rs. 17/8/- each	Rs. 17/8/- each	The Development Officer, Hand Poundiug Industry (M. P. State), Bachhraj Bhavan, Gandhi Chowk, Wardha.	To the Development Officer, Hand Pounding Industry (M.P. State) Bachhraj Bhavan Gandhi Chowk, Wardha by M.O. or draft drawn in favour of Deputy Director, Research Instt., Wardha.
4. Banswara Jilla Seva Sangh, Partapur (Rajasthan State).	Rs. 20/- each	Rs. 10/- each	Rs. 10/- each	The Supervisor, H.P.I. Rajasthan State, Partapur, District Banswara.	By M.O. to the Supervisor Hand pounding Industry Rajasthan State, Partapur, Dist. Banswara.
5. Borhat Union, M.P. Coop. Society Ltd., P.O. Katranka Distt. Midnapur (W. Bengal).	Rs. 40/- each	Rs. 20/- each	Rs. 20/- each	To Borhat Union M.P. Cooperative Society Ltd. P.O. Katranka, Distt. Midnapur.	To the Secretary, Borhat Union, M.P. Coop. Society Ltd., P.O. Katranka, Dist. Midnapur by M.O. or draft drawn in his favour.

Winnowing Fans (For separating husk & Rice)

1. Adarsh Udyog, Mandir Billimora, Distt. Surat.	Rs. 110/- each F.O.R. Billimora	Rs. 55/- each	Rs. 55/- each	The Member-in-Charge, Hand Pounding Industry Patel Hall, Nadiad, Distt. Kaira.	To Khadi Village Industries Commission by M.O. or draft drawn in favour of Adarsh Udyog Mandir. Billimora Dt. Surat.
2. Wardha Jilla Sahkari Gramudyog Sangh, Wardha (M.P. State).	Rs. 110/- each F.O.R. Wardha.	Rs. 55/- each	Rs. 55/- each	The Development Officer, Hand Pounding Industry (M.P. State) Bachhraj Bhavan, Gandhi Chowk, Wardha.	To the Development Officer, H.P.I. State—M.P Bachhraj Bhavan, Gandhi Chowk, Wardha by M.O. or draft drawn in favour of President Wardha Jilla Sahkari Sangh, Wardha.
3. Research Institute, Maganwadi, Wardha.	Rs. 110/- each F.O.R. Wardha.	Rs. 55/- each	Rs. 55/- each	The Development Officer, Hand Poundiug Industry, M.P. State, Bachhraj Bhavan Gandhi Chowk, Wardha.	By M.O. or draft drawn in favour of Dy. Director, Research Institute, Wardha.

Name of Manufacturer	Implement	Price	Amount to be paid by purchaser	Subsidy	To whom & how to send subsidised cost of implements required
		Rs.	Rs. P.	Rs. P.	
1. The Emery Stone Mfg. Co., Kuchamanroad, Rajasthan.	Emery Paddy Chakki F.O.R. Destn.	55	27·50	27·50	To Khadi village Industries Commission by M.O. or draft drawn in favour of. Emery Stone Mfg. Co. Kuchamanroad.
2. Gramodyog Trust, 13/387 Civil lines, Kanpur, U.P.	Stone Chakki for dehusking paddy F.O.R. Destn.	24	12·00	12·00	To the Manufacturer directly.
3. Do.	Winnowing Fan F.O.R. Destn.	110	55·00	55·00	Do.
4. Carpenters Coop. Society, 172, Abu Lane, Meerut Cantt.	Winnowing Fan F.O.R. Destn.	110	55·00	55·00	Do.
5. Do.	Dhenki F.O.R. Destn.	48	24·00	24·00	Do
6. Shri Gopichand Surya Prasad, Fort Rd., Rewa.	Winnowing Fan F.O.R. Destn.	110	55·00	55·00	Do.
7. Bihar Khadi Gramodyog Sangha, Pargania, Muzaffarpur, Bihar.	Winnowing Fan F.O.R. Destn.	110	55·00	55·00	Do.
8. Do.	Dhenki F.O.R. Booking Stn.	34	17·00	17·00	Do.
9. Palasbari Rice Producers' Coop. Ltd., Palasbari, Distt. Kamrup. Assam State.	Dhenki F.O.R. Booking Stn.	32	16·00	16·00	Do.
10. Sarvodaya, Seva Ashram, Baliakothi, P. O. Nasarganj, Bihar.	Chakki F.O.R. Destn.	30	15·0	15·00	Do.
11. The Cottage Industries Development Association, Madurai. Madras State.	Chakki F.O.R. Booking Stn.	36	18·00	18·00	Do.

The implements are given at subsidized rates only to Cooperative Societies and/or Registered Institutions. They are not supplied to industries at subsidized cost. Institutions who desire to purchase any of these implements at subsidized cost may send the subsidized cost of the implement required to the parties as mentioned above, in advance. They are also requested to send a subsidy receipt (in triplicate) in the prescribed form together with the prescribed agreement form duly completed and signed by the officer of the institution. The order will be executed only after receipt of the subsidized cost, agreement form and subsidy receipt.

BEE-KEEPING

Preamble

Millions of trêes, bushes, plants, creepers, weeds and other members of the vegetable kingdom of our country blossom during different periods of the year. The flowers that are born as a result, open and decorate mother Nature for a brief period and then wither away and die. They contain nectar in varying proportions in a majority of cases. The nectar dries up when the flowers wither away and die. Millions and millions of tons of nectar capable of producing several lakh tons of honey are thus lost annually to our country.

Our country is more favourably situated for the production of honey. An estimate of 50,000 tons as an annual production need not be regarded as high or as any thing impossible. At Re. 1 per lb. the value thereof would exceed Rs. 10 crores.

Assuming that the production from a colony averages 10 lbs. and the Bee-keepers rear on an average 5 colonies, the industry is capable of employing 20 lakh of farmers and others practising bee-keeping as part time industry. 20,000 would find employment as full-time workers assisting them in processing honey for the market and in the marketing of the production and also in giving them technical assistance. In this industry, women and children can assist the farmer and relieve him. An initial capital of about Rs. 100 would suffice to start an industry with about 5 colonies. The implements are cheap and simple to manufacture. They can be manufactured almost everywhere out of materials which are easily available everywhere.

SYLLABUS BEE-KEEPING—*Period of Training : 4 months*

Week	Details of Practical work	Drawing	Theory
I week	(1) Recognition of different kind of bees, their sizes and colours—observe the different kind of combs and the construction of Queen cells, Drone cells and worker cells in each variety. Observe the construction of honey cells in Apis Florea variety—study and observe the different habits of bees with special reference to Apis Indica. Study the advantages to domesticate this variety—study the reasons for non-demonstration of Apis Dorsata, Apis Florea and Apis Mellipona—Handling of bees.	(1) The figure of Queen, Drone and worker of Apis Indica and indicate the different parts. (2) Draw a brood comb showing the queen cell, drone cell and worker cell. (3) Draw the reproductive organs of the queen and the drone. (4) Sting of worker bee and queen bee with poison sac.	(1) *Introduction*.—Bees in nature—their origin, their position among animals-Social and beneficial effects—Division of labour—colony organisation—Members of a colony-Queen—Drone and worker—stages in their growth—Life cycles, functions of individuals—Different species of bees. Bees and their contribution to mankind and plant kingdom—Effect of cross pollination—Bee products such as Honey, Wax, Royal Jelly, Bee Venom etc. Sapping the natural resources—Wealth from waste—Employment potentialities in the rural sector.
		(5) Draw a chart showing the development of bee brood. (6) Beds in logs. (7) Bees in Skeps (Decay-hives). (8) Chart showing the advantages and products derived from the bee.	*History of Bee-keeping*.—What is meant by Bee-keeping ? Importance of scientific bee-keeping in our agricultural country—crude collection of honey in olden days. Rearing of bees in earthen pots and logs—semi domestication—Evolution modern bee-keeping as hobby. Study the anatomy of bees. Their special parts and their functions.
		(9) Honey—its composition.	
II week	(2) Acquaintance with bee appliances and their usage : (*a*) Study the different types of frame hives found in India and other countries abroad. Detailed study about Rev. L.V. Newtons hive—Measurement of bee-space—study	Draw a sketch of hive showing all the outer and inner dimensions. Draw the diagram of smoker, honey extractors, Queen excluder etc. Flow chart showing the organisational set up of Bee-	*Equipment*.—Brief outline on the invention of equipment used in Bee-keeping industry with special reference to modern movable frame hive, centrifugal honey extractor, smoker, excluder sheet and comb foundation sheet. (*a*) *Standardisation of equipment—Protective equipment*.—Bee-veils, gloves

	and measure each and every part of the hive. (*b*) Protective equipment such as 'Bee Veil,' 'Hand gloves,' smoker etc. Detailed study regarding the construction of a smoker and how it functions. (*c*) Equipment for capturing a wild colony or swarm.—Hive transport box, match box—Swarm catching bag—Queen gate—string or fibre. (*d*) Equipment needed for routine apiary management, Queen Excluder, Dummy board or Division introducing cage—Bee escape, hive stand—Antwell—comb foundation sheet and how to mount it in the frames. (*e*) Equipment for Honey extraction and marketing of honey—observe the different type of extractors and how they function—Honey containers—Honey—labels, wax processing plants.	keeping industry of K.V.I.C.	smokers bee dress etc. how they can be used. (*b*) *Equipment for capturing a colony*—Hive, Queen gate—Fibre or string. (*c*) *Equipment needed for routine apiary management.*—Queen Excluder, dummy board or division board, Queen introducing cage, Bee escape or super cleaner Drone trap, hive stand Ant-well-comb foundation sheet. (*d*) *Equipment for honey extraction.*—Different types of extractor (Radial and tengential, uncapping knife, Honey filters, honey containers. Honey processing plant—wax processing plant.
III, IV and V week ..	(3) Location of colonies—Bee hunting capturing of natural colonies from a hole of a tree trunk—capturing of swarms—the Different methods to capture them. Transfering a colony or two from the decay hives to modern hives—(Pot hive and log hive).	Nil	(3) *How to start with bees*— (a) Purchasing a colony (b) capturing a natural colony from the tree trunk hole. (c) capturing a swarm (d) Transferring a colony from decay hives skems etc. Location of natural colony—Bee hunting—Method to find out the location of natural colonies, capturing a natural colony. What are the precautions to be taken while capturing a colony. The suitable time for capturing of colonies and shifting them to the apiary—Precautions to be observed for Drone in the apiary before settling the colony.

SYLLABUS BEE-KEEPING—*contd.*

Week	Details of Practical work	Drawing	Theory
VI week	(4) Arranging an apiary at new site-Selection of site—water facilities—Availability of flora throughout the year within radius of ½ mile—location of hive—Direction of hive faces.	Nil	(4) *Arrangement of an apiary.*—Selection of site—arrangements of hives—Direction of wind—Availability of bee flora—sources of water—Determination of the maximum No. of hives in an apiary depending on the availability of flora within the foraging range of bees.
VII & VIII week ..	(5) Examining of colonies—Examining of a queenless colony—Examining a colony having supercedure queen cell—Examining a colony having a high swarming fever—Examining weak colonies and strong colonies—Remedies to be done—Examining a colony having laying workers—While examining, the following points to be observed (*a*) : Performance of queen in egg laying, (*b*) Pollen and storage (*c*) comb building activities, (*d*) Drone breeding, (*e*) Presence of queen cells. Remedy if any of defect found—Build up the strength of weak colonies—the Bee enemies and remedies for them.	Nil	(5) *Examining of colonies.*—Necessity of examining a colony—Time suitable for examining a colony—What are the precautions to be taken before examining a colony—What are the points to be observed while examining a colony—Building up the strength of a colony—Equalise the strength of weak and strong colonies.
IX & X week ..	(6) *Routine apiary management.*—Control the swarming tendency, robbing, fighting and desertion of colonies—irregular combs like lur combs and brace combs—How they can be rectified—Feeding of bees—different methods adopted in feeding the bees—The preparation of artificial sugar syrups and pollen substitutes—cleaning of bees off from the brood and super combs—The adding of supers and removing of supers—Why and how ? Elimination of drones.	Nil	(6) *Routine apiary management and special manipulation*—What is swarming—swarm and desertion of a colony—How it can be controlled—Robbing, fighting and desertion of colonies and remedies for them—Irregular combs—How they can be rectified. Artificial feeding—The preparation of artificial sugar syrups and pollen substitutes—The adding of supers and removing of supers—Why and how? Elimination of drones—Why and how ?

XI Week	(7) Individual hive record—Inspection note flora register—Reports of weather—Rainfall—Record showing the yield and other performance of an individual colony or queen.	Nil	(7) *Different forms and registers relating to the working of individual bee colonies*—How to maintain the flora register--How to supplement the floral condition in the off-season—Reports of weather etc., list of bee keepers.
XII. Week	(8) Observation of bee enemies and protecting the hives from their attack with special reference to the life cycle of wax-moth and yellow banded-wasp. Study the various diseases of bees and the remedies for them.	Nil	(8) *Natural enemies and diseases of bees : protective and curative measures*— 1. Wax-moth—its life cycle. 2. Yellow banded wasp. 3. Lizard 4. Chemilion 5. Bee Eater (Bird) 8. Beetle. 9. Spider 10. Bear 11. Greedy and curious man etc.
XIII & XIV Week ..	(9) Uniting of colonies. Different methods (*a*) by applying common smell such as face powder, scent etc.; (*b*) By placing a news paper in between two colonies (paper methods); (*c*) By reducing the space gradually in between two colonies; (*d*) By applying smoke for both colonies; (*e*) By shifting a queenless colony to adjust the distance of a furlong or two and clearing off the bees and placing with a queen colony in the place of queenless colony etc. *Dividing of colony.*—Different methods in dividing—(1) Dividing of a colony into two and introduce a spare queen by means of common smell. (2) Dividing a colony having a queen cell or cells. (3) If queen cell is not available divide a colony into two and make three worker cells into one queen cell so as to enable the bees to erect supercedure queen cell.	Nil	(9) *Uniting and dividing of colonies : different methods adopted*—Reasons for uniting and dividing. The following abnormal conditions and how they can be made good. Queenlessness—fighting—absconding—laying workers—supercedure queen cell.
XV Week . ..	(10) Honey extraction and marketing of honey : Uncapping of honey combs —extraction of honey—Filtering—	Nil	(10) *Honey collection*—Crude method adopted in olden days—Scientific method—Blending of honey—Study

SYLLABUS BEE-KEEPING—*contd.*

Week	Details of practical work	Drawing	Theory
XV week—contd.	processing of honey—Blending of honey—storing, bottling, labelling and packing, Transport facilities, Marketing. Study the different varieties of honey with special reference to the specific gravity, colour and viscosity, water content of honey.		the composition—value of honey—preservation of honey—colour—viscosity.
XVI. week	(11)(*a*) Packaging of bees to a short and distant places. (*b*) *General.*—Finding the cost of production of honey—Arranging an exhibition—How to display the articles—Processing of wax.	Nil	(11) Migratory bee-keeping—packaging bees to long and short distances care of bees at the destination—wax—its importance and value—how it can be collected. (12) *General.*—Organisational set-up of bee-keeping industry under the Khadi and Village Industries Commission—financial aid offered by Khadi and Village Industries Commission for the development of bee-keeping—State aids for the development of bee-keeping, important role of khadi and village industries in our national economy with special reference to the Bee-keeping industry—Gandhian philosophy so far as it relates to village industries—How to approach the villagers acquaintance with village conditions.

NOTE.—The trainees should read the following books in the training period and take notes.—

1. Bee-keeping in South India—*By Shri S. Ramachandran.*
2. Romance of Scientific Bee-keeping—*By Shri Satish Chandra Das Gupta.*
3. Curative properties of honey and bee venom—*Russain publication.*
4. The encyclopaedia of Bee-keeping—*By Alexander Deams.*
5. Cent per cent swedasi. —*By Mahatma Gandhi.*

LESSON PLANS

PART I—*Bee-life in nature*

1. The world of bees	Different races of Bees—their description, distribution and distinguishing features. The different kinds of bees in India, Apisdorsate, mellifica, florea, and melipona, their characteristics and habits.
2. The social structure of a bee colony.	Introduction—Sociability of Bees—The spirit of the Hive—the aim of common good—every consumer a producer—the division of labour a colony compared to that of a state—Description of a comb—the order of cells the bee as an Architect, and a builder—A bee hive an epitome of a world by itself revealing the spark of life and its struggle towards perfection.
3. The individuals of a bee colony	The members of a colony—Queen—worker—Drone—How identified—Stages in their growth—their rights and responsibilities and the story of their lives.
4. The march of life and other events in a Bee colony.	A swarm of bees—clustering on a branch or some other support—its disposal and march towards a new home—settling and building new combs—secretion of wax—foraging—Brood rearing growth of the colony and the period of prosperity—preparation for division—surplus honey store—raising of drone brood—appearance of queen cells—swarming fever—after swarming the life cycle of a colony.
5. The Bees and their needs ..	Kind of shelter—Food (Pollen and Nectar), the need for water—propolis etc.—Bee pasture—Wild and cultivated—tree flora, Ground flora—trees, plants, shrubs, climbers, etc. useful for Bees.
6. The Bees and their contribution to human welfare.	Honey—Wax—Pollen, rich and highly nutritive article of food—Royal jelly and Bee Venom—their place in Medicine and their wonderful curative properties etc. Better and more crops, seeds by their service of cross-pollination of flowers—their giving employment to many—their valuable lessons to mankind about life in a welfare State or community life—their role in the promotion of health, wealth and wisdom.

PART II—*Bee-life under domestication*

(*a*) Semi-domestication of Bees

1. Primitive bee-keeping ..	General and introductory—Nothing but simple robber—the crude and destructive processes involved in the collection of honey from wild colonies—severe shock and loss of life to Bee colonies—the most uneconomic way—detrimental to bee growth and consequent results in low yields of honey, field crops and seed production.
2. The use of Decoy Hives in the rearing of bees.	Methods used for exploiting bees in their wild and natural state—The Hollowlog, earthen pots and wooden cases smeared with honey and wax inside to attract bees—the periodical removal of honeycombs leaving the brood undisturbed—method of

	extraction of honey—the waste and the loss of combs involved in the system—the disadvantages that come in the way of greater production of honey special and seasonal manipulations of bees and their working.

PART III—*Modern and Scientific Bee-keeping*

1. Historical facts about bee-keeping the Evolution of modern bee-keeping.	Brief outline of the evolution of modern bee-keeping—the invention of movable frame hives, the use of centrifugal honey extractors, comb foundation sheets, food substitutes, other devices to have effective control over the bees, the use of artificial insemination of queen bees, the migratory bee-keeping outfits and other labour saving devices to enhance production of honey and the increase in bee population.
2. Applied bee-keeping. The Bee hive and other essential appliances and tools.	The Bee hive and its parts—the honey extractor—different types, smokers—hive tool, veil, gloves, uncapping knife, comb foundation sheets, Queen excluder sheets, the Queen gate or the entrance guard, the drone trap, bee escape, queen rearing equipments, queen cages for mailing, other tools and appliances—Honey processing, storing equipments, etc. and their use, principles involved in their manufacture. The different types of hives that are in use in India and abroad
3. How to start with bees ..	Procuring of bees—hiving a swarm of bees—transferring a colony of bees from a tree cavity, and hill, crevices in a wall, from a pot and from other odd places—the right season to start—the care in the handling of bees while hiving—the need for patience etc:
4. Apiary and its location ..	Choice of site—arrangement of hives—essential points to be considered—direction of winds—availability of morning sun shine—condition of the ground and the immediate environment abundance of bee flora within bee flight range—source of water—determination of the optimum number of hives in an apiary depending on the availability of flora within the foraging range and the kind of flora available for surplus honey or for the raising of bees and their maintenance—over stocking etc.
5. The care of the bees	(*a*) Study of the Bee Anatomy and Physiology—the special structures and their functions—bee behaviour or the bee psychology—the instinct senses of Bees—handling the newly hived bee colony—the need for close observation—settling the unsettled—feed natural and substitutes—other manipulations when and how to do and what not to do—the sting how to avoid stings—remedies finding the presence of Queen—study of other conditions obtained in the bee colony—the need for recording the observations made during the periodic inspections.
	(*b*) Natural enemies and diseases of Bees—protective and curative measures.
6. Hive record and weather report.	Different forms and registers relating to the working of individual bee colonies, the Apiary, the group of apiaries and Bee Centres, the record of daily temperature—chart form minimum and maximum the rainfall, humidity, hours of sun shine, velocity and direction of wind and other conditions that favour growth and welfare of the bees or otherwise.

7. Special manipulations of Bee colonies before, during and after the honey flow season.	Building up of colonies, the use of young and vigorous queens—supply of combs—fresh drawn combs--comb foundation sheets—pieces of combs —increase in worker brood and its vital need and place at the right time for honey production—control of drone brood, swarm prevention-supply of supers—uniting of colonies etc. Robbing among bees—causes, damage done, control presence of flaying workers—how to get rid of them—other seasonal manipulations.
8. Abnormal conditions and how to control them.	Queenlessness—starvation, dwindling, drifting, fighting, absconding etc., crowding at the entrance —clustering on to the roof—clustering outside leaving the combs—no flying bees at the entrance or very slow working as compared with other hives—no bees at the entrance—many bees fanning—restlessness—correct diagnosis and prompt treatment of colonies.
9. Swarming and all about it ..	Definition—swarming and swarming out—the "why" and "how" of swarming—the impulse how controlled—artificial swarming—recapturing of living of swarmed bees.
10. Queen rearing and bee breeding.	Principles involved—factors vital for the improvement of the strains and their survival for better performances—different methods of raising queens and their introduction to other colonies—commercial queen breeding—mating—equipment specially required—nucleus hives—the right seasons to attempt—queen raising and bee-keeping.
11. Migratory bee-keeping and transport of bees—queen bees etc.	Outfit for Migratory bee keeping—test hives to determine—the suitability of the location—the care and the move of bees. Transport of packages bees, queens etc., over long and short distances—care of the bees at the destination.
12. Hive and its products—honey and bees-wax.	How to extract and process (*a*) Honey—different types-composition, properties, value and use as food and medicine, demand production—extracted honey, comb honey, Granulated honey—testing, grading, blending, standardisation, adulteration, containers—storing and other care—packing, labelling, displaying etc., honey house. (*b*) Bees-wax its production—composition—properties—adulterants—Commercial uses, demand, its marketing etc.

Part IV—*Bee-keeping Industry* (*Commercial and Organisational*)

1. (*a*) Costing for bee-keeping	Existing and better methods of marketing—the financial assistance programme of the Khadi & Village Industries Commission.
(*b*) Cooperation	Principles—benefits—organization of cooperative societies. Rights and responsibilities of membess—Account books & registers of Cooperative Societies etc.

PRACTICAL BEE-KEEPING : LESSONS AND EXERCISES

1. Recognition of a Bee, the different kinds of bees and their combs.
2. The Bee hunt or finding the location of natural bee colonies.
3. Measuring, assembling and drawing sketches of the frames and other parts of the hive.
4. Wiring frames, fixing or fastening of comb foundation.
5. The use of bee equipment.
6. Transferring a colony from a tree hole or log, from the crevice of a wall, and hill pot etc.
7. Hiving a swarm.
8. Selection of site for an apiary.
9. Layout of the apiary, arrangement of hives.
10. Examining a colony—handling of hives.
11. Spotting the queen—examination of the condition of brood, storage of pollen and honey comb building activity, condition of combs—presence of enemies like wax-moth and other undesirable insect pests etc.
12. Clearing of bees off the combs.
13. Observation on other bee enemies and protecting the hives from their attack.
14. Feeding, different methods.
15. Stings how to avoid and remedies when stung.
16. Special and seasonal manipulations—uniting of colonies, dividing of colonies—dequeening, requeening, queen rearing, adding supers, removing supers, the use of nucleus hives, the use of multiple queens etc.
17. Controlling swarming; different methods.
18. Moving bees over short and long distances.
19. Nectar and pollen yielding plants and their recognition in the field.
20. Extraction of honey and wax-uncapping, extracting, filtering, processing, storing, bottling, labelling, packing, transport and marketing.
21. Studies on the grading of honey.
22. Finding the cost of production of honey.

During the course of training, the trainees will be required to capture a number of colonies, their transfer and setting up, and examine as many as possible of beehives and colonies.

LIST OF EQUIPMENT REQUIRED FOR BEE-KEEPING CLASSES

I. *Protective Equipments*

1.	Bee Veils	2
2.	Bee glover	2 pairs
3.	Smoker	1

II. *Manipulating equipments*

1.	Hive tool	1
2.	Roller cloth	1
3.	Bee brush	1
4.	Queen cage	1
5.	Swarm net	1
6.	Knife	1
7.	Sprayer	1

III. *Hive and its accessories*

1.	Hive body (with bottom boards, super-inner-covers, Dumy-boards and top covers).	10 (including one observation hive).
2.	Queen [illegible]	1
3.	Ent[illegible]ran[illegible]	10
4.	Hi[illegible]ve st[illegible]	10
5.	A[illegible]nt wei[illegible]	40
6.	Quilt[illegible]	10
7.	Scree[illegible]	10

IV. *Extracti[illegible]pments*

1.	Extractor	1 (four framer)
2.	Uncapping knife	1
3.	Uncapping tray	1
4.	Capping strainer	
5.	Bee-escape with board	
6.	Honey strainer	
7.	Honey container (storage tank)	

V. *Other equipments required for management of Apiary*

1.	Feeders	10
2.	Feeding board	1
3.	Queen introduction cage	1
4.	Drone trap	1
5.	Swarm trap	1
6.	Swarm catcher	1
7.	Nucleus boxes	1
8.	Screen board	4
9.	Comb cutter	2
10.	Gum tape	1
11.	Comb foundation sheets	1 lb.
12.	Show case	2
13.	Almirha	1

VI. *Carpentry & digging tools*

1.	Hammer	1
2.	Chisel	

3. Pliers	1 (pair)
4. Wood file	1
5. Saw	1
6. Hatchet	1
7. Bill Hook	1
8. Garden spears	1 (pair)
9. Spade	1
10. Pick axe	1

VII. *Equipment for botanical collection*

1. Blotting papers (standard size)	1 quire
2. Herbarium mounting sheets (standard size)	50
3. Herbarium Press	1
4. Vasaulum	1
5. Cellophene adhesive tape	1 roll
6. Copper sulphate	2 ozs

VIII. *Other useful equipments*

1. Forceps	1 pair
2. Disecting needles	2
3. Magnifying glass	1
4. Test tubes	2 doz.
5. Slides and the cover slips	1 pack
6. Entomological pins	$\frac{1}{2}$ oz.
7. Insect box with cork board	1
8. Glycerine	$\frac{1}{4}$ lb.
9. Formalin	$\frac{1}{2}$ lb.
10. Pare-di-chlore-benzene	$\frac{1}{2}$ lb.
11. Glass rods	4 ozs.
12. Pipets	2 doz.
13. Beakers	2
14. Watch glasses	$\frac{1}{2}$ doz.
15. Petri Disher	4
16. Model Honey bee workers	4
17. Thermometer	1

IX. *Queen Rearing Equipments*

1. Cell bars	4
2. Nursery cages	12
3. Queen cell protectors	12
4. Queen cell holders	12
5. Cell moulding sticks (dipping rod)	2
6. Grafting tools	1
7. Barbian cell punch	1
8. Wax brush $\frac{1}{2}$″	1
9. Vertical queen excluders (size of frame brood)	2
10. Sheet horizontal queen excluders	2
11. Queen mailing cage	1
12. Spirit lamp	1
13. Flannel cloth	2 pieces (12″ × 18″)
14. Hot water bottle (Rubber)	1
15. Queen cell carrier	1
16. Warm box	1

BOOKS ON BEE-KEEPING AND BEES

1. Bee-keeping in South India—*by Ramachandran.*
2. The hive and the honey bee—*by Roy A. Grout.*
3. The Encyclopaedia of Bee-keeping—*by Alexander Deams.*
4. The Bee—*by Gertrude Hess.*
5. The A.B.C. and X.Y.Z. of Bee Culture—*by A. I. Root.*
6. Queen Rearing—*by R. L. Shelgrove.*
7. Swarm Control and Prevention—*by R. L. Shelgrove.*
8. Queen Introduction—*by R. L. Shelgrove.*
9. The Anotomy, Physiology and Natural History of the honey bee—*by Herold Hampsell.*

BEE JOURNALS

1. The American Bee Journal.
2. Gleanings in Bee Culture.
3. The India Bee Journal.
4. The Madhuvan.

FIBRE INDUSTRY INCLUDING BRUSH MAKING

Preamble

In the rural areas, various types of vegetable fibres are available such as coir, sisal, hemp, etc. Over and above palm leaves and petioles are also available abundantly. Training courses in the industrial utilization of these raw materials by adoption of simple techniques in the rural areas will be very useful. But in view of the availability of different types of fibres areas, it will be necessary to draw up training schemes according to the needs of the areas. The syllabus has, therefore, been divided into the following categories :—

(i) Fibre works in general—with sisal, coir, hemp etc. Duration—*one year*.

(ii) Coir fibre work—*six months*.

(iii) Rattan (Neera industry) from Palmyra Petiole—4 *months*.

(iv) Brush making from palmyra fibre—4 *months*.

(v) Palm leaf works—4 *months*.

SYLLABUS (FIBRE WORK IN GENERAL)

PERIOD OF TRAINING : (*a*) *First Stage* —26 weeks; (*b*) *Second Stage* —26 weeks } 52 weeks.

Week (1)	Details of Practical Work (2)	Drawing No. (3)	Shop Talk (4)	Lectures (Subjects) (5)
First Stage :				
1.	Identification and use of minor ols like harvesting knife and country spindles—showing the harvesting, retting and extraction of fiber from retted materials.	—	Safety precautions in handling the knife.	(1) General idea of the industry—Availability of raw materials—names—sisal, hemp, coir, reeds etc. Proper harvesting (one hour). (2) Retting of fibre materials—harvesting, drying, digging pits—keeping under water—Removal after softening (one hour).
2.	Identification and use of improved equipment—Raspadar—Fibre carding machine—Fibre spinning machine—Coir Spinning wheel.	1. Raspadar. 2. Fibre carding. 3. Fibre spinning machine. 4. Coir spinning wheel.	Safety precautions in handling Raspadar and Fibre carding machine.	General description of the uses of Raspadar machine, Fibre carding machine, Fibre spinning machine and Coir spinning wheels. (Four lectures, one hour each daily).
3 &	Harvesting the fibre materials and extraction of Fibre on Raspadar.	Raspadar machine.	Precautions in handling.	Description of Raspadar—Extraction of fibre-keeping under water for half an hour—washing—drying (one hour).
5 & 6	Continuation of extraction of fibre on Raspadar and also to card the fibre on Fibre carding machine.	Fibre carding machine.	Do.	How to card the fibre—removing the knots—passing through the machine—removing pithy matter making fibre parallel—rolling it into slivers (one hour).
[illegible]	Extraction of fibre by scrubbing method.	—	Point to note—use of blunt knife and plank.	Extraction of fibre by scrubbing method. Keeping the green leaf on a blank scrubbing with plank knife—washing drying (one hour).
[illegible] & 9	Preparation of rough braid mats	—	Colour combination.	How to prepare rough braid mat. Prepare braids by baiding the rough and waste fibre. Stitching to the required shape (one hour).

(1)	(2)	(3)	(4)	(5)
10	Spinning on country spindles	—	Points to watch the balancing weight.	Disadvantages of using the country spindles—advantages of replacing it with improved type machine (one hour).
11	Spinning of single ply yarn on spinning machine.	Fibre—spinning machine.	Points to watch—Flyers—weight on the groved pulley.	How to work on Fibre spinning machine—healding—beading the fibre—adjusting the weights
12	Willowing of coir on willowing machine.	Willowing machine.	Precautions for safety in feeding the raw material to the machine.	Willowing machine and its parts, How to use it—care in feeding--making soft—removing fibres, rolling into slivers.
13 & 14	Spinning on coir spinning . .	Coir spinning wheels.	Points to watch—tension of the rope in pulling and turning.	(1) Coir spinning wheel—its spendus pulleys—wheels—object of stationary wheel and movable wheel (one hour). (2) How to work—taking the slivers—attaching the fibre turning to impart twist to individual ply—counter twist to make yarn (one hour).
15	Preparation of single ply rope yarn on ply making machine.	—	Points to watch twist (hard or loose) and adjustener.	Ply making machine—its advantage over the country type equipment —preparation of ply (one hour).
16	Doubling of single ply—yarn on doubling machine.	Doubling machine.	Brackets carrying bobbins to be watched.	Doubling machine—its use and care—special reference to bracket carrying the bobbins.
& 18	Preparation of two ply yarn on Japanese type straw Rope making machine.	Japanese type rope making machine.	Points to watch-feeding finnels and drawing chutes rollers.	(1) Japanese straw rope making machine and its parts (one hour). (2) Its working—feeding time—imparting individual twist—weaving two ply yarn with automatic counter-twist —drawing in paper yarn and automatic winding on drum (two lectures of one hour each).

19	Preparing two ply yarn on the Japanese type Rope making machine.	Japanese type straw rope making machine.	Points to watch drawing roller and twist.	Calculation to find the count of yarn (one hour).
20	Sorting of yarn for further exercise	—	Points to watch uniformity.	How to sort out the yarn—uniform twist—uneven twist even thickness, thickness uneven etc. (one hour).
21 & 22	Preparation of Cordage	Rope making machine.	Points to watch. Proper twist to individuals straws and counter twist.	How to prepare cordage—preparation of shauds—imparting individual twist—use of rope guide—counter of twist coiling the rope (one hour).
23 & 24	Preparation of Rope	Rope making machine.	Points to watch. Proper twist to individuals straws and counter twist.	(1) Difference of rope and cordage. (45 minutes). (2) How to prepare rope—same as cordage but thicker than 3/4" diameter. (one hour). (3) Details of rope making machine and its parts—hook—pinions—gear wheel—Stationary machine and machine on trolley (one hour).
25&26	Bhattar making and ply for Bhattar	—	Demonstrating the technique of drawing in through the healds and reed.	(1) Bhattar or Bondry making—arranging the warp—heddling tie-ups weaving (one hour). (2) Advantages of using improved tools (one hour).
Second Stage 27	General test to the trainees to put them in the right section for consented production after ascertaining what they know. During this week the aptitude of the trainees will have to be watched to put them in proper section of this Industry for specified training.			
28	Bleaching of Fibre materials	—	Points to watch mixing the chemicals, boiling the water treatment on acid.	Bleaching of fibre and yarn. Mixing bleaching powder in water, dipping the material with the both—removal after two hours—treatment with the acid—drying (one hour).

Syllabus—Contd.

(1)	(2)	(3)	(4)	(5)
29	Dyeing of fibre and yarn	—	Mixing of dyes.	(1) Selection of dyes—basic dyes (15 minutes). (2) Method of dyeing—softening with alum—boiling the water—mixing the dyes—inserting the material into dye—bath—turning the material upside down keeping it over night—drying (one hour).
30	Preparation of braids for fancy articles.	—	Selection of prope colour.	How to prepare fancy articles—prepare braids—Stitch one round the other to required shape finishing (one hour).
31	Sorting of yarn	—	Points to observe thickness, twist and evenness.	(1) Object of sorting (45 minutes). (2) How to sort—Eliminate thick and thin portion—separate thick yarn—thin and medium yarn for different job (one hour).
32	Winding the yarn	—	Point to watch uniformity.	How to wind on spools—keeping the spool on stand—Yarn on pirn taking in last end—winding uniformity (one hour).
33 & 34	Preparation of fancy articles ..	—	Precaution on using the needles.	Method of preparing fancy articles (one hour).
35 & 36	Warping and Beaming	Creel and warping drum.	Point to watch— (1) Preventing entanglement (of yarn) (2) Light and loose effect.	(1) Warping—spreading the spools in the creel. Taking through reeds-preparing section by section of warp. (one hour). (2) Beaming—taking the ends through the dents—winding on the warp roller
37, 38 & 39	Weaving of Plain matting . ..		Points to watch proper healding & tie-ups.	(1) How to weave—placing the warp. roller on the loom—healding drawing in through the dents of the reed—tie ups—weaving (one hour). (2) Discussions on healds, reeds and other parts of the loom (one hour).

40, 41 & 42	Preparation of twill matting ..	Do.	Examine the twill effect.	How to prepare twill weave—graph paper—plot the design (one hour).
43	Preparation of herrenglone design	Do.	—	How to prepare herren bire effect —same as twill with zig-zag effect (one hour).
44 & 45	Preparation of diamond matting and endoker weave.	Creel and warping drum.	Point to note—The fleat of the warp should not be more than three weft.	(1) Plot the twill design in square for diamond and (2) Broken (one hour each).
46 , 47 & 48	Preparation of Carpets	Do.	Point to note—warp should not be visible.	(1) How to prepare carpet—Prepare warp —pick up the weft very close—take out designs as per sketch (one hour each for 2).
49 & 50	Stencilling of matting of carpets and preparing bags from matting.	—	Points to watch proper placing of stencil and printing.	(1) How to stencil—cutting the stencil as per design—placing it on the matting—application of colour on the spacing (one hour). (2) How to determine the cost—cost of materials—wastage—overhead charges—(one hour). (3) How to prepare bags—cut the material to required size—stitching three sides—attaching handle on the fourth side (one hour).
51 to 52	Final examination.			

LESSON NOTES ON MAKING OF FIBRE ARTICLES

I. *General* :—All fibres are broadly divided into two main groups *viz*. (1) Natural fibres and (2) Artificial fibre. Almost until the end of the 19th Century, natural fibres were only used for textile and other purposes. But by the end of the 20th Century, efforts made to manufacture artificial fibres in India were successful.

Artificial fibres includes all kinds of synthetic fibres such as nylon as well as the semi-synthetic fibres such as rayon. The manufacture of the artificial fibres is not in the scope of village industry and hence has not been dealt with here.

Natural fibres are sub-divided into :—

(a) Animal Fibres;
(b) Mineral Fibres; and
(c) Vegetable Fibres.

Animal and mineral fibres come under textile and woollen industry and hence have not been dealt with here.

Vegetable fibre is the fibrous material obtained from any plant, herb, shrub or tree. Every plant has fibres in one form or the other. Some have thick layers of fibre while some others have thin layers. Some have hard fibres and some have soft. Some have strong fibres while some have weak and so on. Some plants yield fibres as by-products, some other fibre plants grow wild under natural conditions and other are specially cultivated for fibre industry and the following are some of the examples of these three varieties :

1. Fibre as by-product is obtained from coconut husk, palm trees (palmyra, Date Indian sago) linseed straw, banana hemp, plantain trees etc.
2. Fibre is obtained from wild grown plants like sisal reeds, grass, barks of unlimited number of trees grown wild in the forest.
3. Fibre is obtained from specially cultivated plants like sunnhemp, Daccan hemp, jute, ramie, flax, cotton etc.

II. Sisal is the most important fibre yielding plant amongst the wild grown plants in India. It is cultivated on large scale in countries like Africa where hundreds of tons of fibre are extracted every day from the leaves of sisal plants. The statistics regarding the acreage of sisal plantation in India are not available. However, in Bombay State the approximate plantation will be nearabout ten thousand acres.

There are four species of sisal plants known as (i) Agave cantala, (ii) Agave sisalana; (iii) Agave veracruze and (iv) Agave weighte. Of these, the fibre contents in Agave sisalana and Agave cantala is more. Agave cantala has 4 per cent and Agave Sisalana 5 per cent fibres. Agave sisalana has no marginal spines while Agave cantala has the marginal spines. These plants grow wild. These are grown as the hedge plants, but no systematic cultivation of sisal is carried on for industrial purpose in India.

To have the cultivation of sisal plants, it is desirable to have a nursery. The bulbing (young plants those appear on the flowering shoot of the parent plants) are first taken care in the nursery till they grow about 12″ or more in height and produce 12 to 18 leaves before they are transplanted. Besides the bulb, the suckers; the young off-shoots appearing round about three feet apart are also useful and need to be cared for. The approximate number of plants that can be transplanted in one acre is 720. It is desirable to irrigate the plats till they come up well. When the plants are about four years of age, the leaves are ready for harvest. The leaves which spread away from the parent plants to an angle of 45 degrees or more should be harvested to keep the plants healthy. Villagers sometimes harvest the leaves which are very tender and not even separated from the stem. By so doing, the plant will die soon.

The leaves are harvested twice a year, preferably in April and October. The leaves are then retted in water and fibre extracted or the leaves are passed through the Raspadar machine and the fibre is extracted. In the South Madras the fibre is extracted by the scraping process.

Retting method is commonly employed in Bombay, Mysore and Andhra States. The leaves are tied in small bundles and kept under water for seven to fifteen days. In some places the leaves are splitted into narrow strips before putting in water so as to shorten the retting period to four to six days. When the leaves are properly softened, they are rinsed in water and the fibre is separated from the pithy matter after beating it with a wooden mallet.

The Working on the Raspadar Machine is as Follows

One man takes two or three leaves at a time and feeds them in such a way as the tip ends of the leaves are inserted first into the feeding slit of the raspadar holding the other end tight. When almost the entire length of the leaves is dragged inside by the movement of the drum of the machine, it is drawn back by pulling the end held in hand. By the time the leaves are pulled back, the entire pithy and green matter will be made soft and removed by the beating and rasping of the blades in the drum. Now the butt end is inserted by giving a jerk and when this end is also rasped the fibre is kept in water for about fifteen minutes and washed properly. This is dried, packed and despatched to the centres where it is converted into yarn, rope, matting etc. More details of the machine are given separately in this note.

Scrapping Process is as follows

The leaves are kept on a flat wooden block holding one end of the leaf firmly with the help of the thumb of the left foot, the pulp and the green matter are scraped away with the help of a blunt knife having handles on either end. When the entire portion except the end under the thumb is rasped, the end which is held under the thumb is kept on the log and rasped as before. The fibre is then cleaned in water and dried. This is then sent for further processing.

III. Munj is one of the wild grown grass in the desert areas. A thin cane like stem grows from this grass to a height of nine to fifteen feet. Covering like sheathers are found in each knot of this stem. The layers of sheathers are separated and beaten with wooden mallets without retting till the pithy matter is removed. This fibre which is known as 'Munj fibre' is converted into two ply yarn for reeling the cots. This yarn is termed as 'Vahu'. The canelike stem is termed as 'Khanas' which are used as the raw material for the preparation of the framework of chairs and teapoys.

Kora Grass : Grows in marshy places. It is generally used for the preparation of kora mats. Superior mats are prepared by splitting the fresh grass into thin pieces and dyeing it properly. The splitting is done with the help of a pointed knife. The grass should be fresh. After drying the splitting will be difficult and at the same time it will not take its required shape.

IV. *Coir* : Coir is the common term used for the fibre extracted from the coconut husk. This industry has been well established in the west coast of India especially in Kerala State. The largest area under coconut cultivation in the world is said to be Phillipines and India with East Indies comes next. But Indian coir and a portion of Ceylon coir are considered to be best suitable for spinning and it is estimated that in India over 1.5 million acres are under coconut cultivation and the bulk of the coconut areas in India lie along the west coast where natural facilities are available for processing the coconut husk economically for fibre extraction. It is estimated that there are about 2100 acres under coconut cultivation in the Bombay State. Every part of the palm is put to some useful purpose. Its nuts when tender supply delicious drink; when ripe yields copra and oil which is widely used in cooking, soap making, candle making and the toilet articles etc. The unopened efflorescence (flower bunch) if tapped, yields toddy which is converted into arrack and spirit. The sweet toddy if evaporated by boiling, brings forth jaggery which when refined gives sugar. The shell of the nut is used for making soap cases, buttons, buckles, spoons and dishes, the leaves are used for thatching the houses. The mid ribs of the leave are used for brooms. The trunk of the palm is used for beams required for construction of buildings and husk yields coir fibre for manufacture of coir yarn, cordage, ropes, mats, matting, brushes, etc.

Information about the output of husk is meagre and is of doubtful accuracy. The enormous variation in the number of palms per acre, the proportion of bearing trees and the number of nuts per palm in different areas under different condition come in the way of making reliable estimates of production of coir fibre which is the main raw material for coir industry.

However, an average of 75 to 80 trees per acre and an average yield of 36 nuts per tree may be considered to be reasonable. Ordinarily 12,000 husk of fairly good size of coconuts would produce one ton of coir. At present only a small percentage of the husk is utilised for the coir industry in the Bombay State while about 65 per cent of the available husk in the Kerala State is reported to have been brought to industrial use. In order to develop coir industry, it is essential to de-husk the nuts when it is in green condition. The nuts are plucked before they begin to dry and are immediately de-husked. The husk is transported for retting.

Retting : The term retting is applied to the process of keeping the coconut husk in water for a period ranging from four to twelve months in order to soften the pith and bind the fibre together. When the husk is properly retted, it would be soft enough to enable the coir to be separated from the pith etc. with a few strokes of wooden mallet.

The following methods are adopted in retting of coconut husk :

1. Staked in shallow water;
2. Hung in nets in back waters where it is not too deep;
3. Submerged in fields closely connected with canals or backwaters.

4. Pits placed in sandy soil close to canals where entrance and exit of water is possible by percolation.

Husk is also retted in shallow ponds where the water is stagnant but the coir extracted from such husk is very inferior in quality.

Extraction : The husk thus retted is removed from the retting pits after rinsing it in water to remove the mud present over it. Thereafter removing the short fibre near the stem end of the nut and the other skin of the husk by hand, the husk is placed on a log of hard wood or stone and beaten with a wooden mallet. As and when a few gentle mallet beating is given, the pith and other matter present on the husk fly away to the sides, leaving behind the coir fibre. The coir is then passed through a willowing machine. The coir fibre coming out of the machine is clean and the strands that are coming out of them automatically gets removed. Thus fibre is then rolled into small rolls after sprinkling a little watter and spun into yarn on coir spinning wheels.

(V) *Jute* : Jute is one of the cultivated fibre plants. Fibre is obtained from the bark of the plants. The plants grow to a height of 10 to 20 feet. It requires fertile soil. The plants take about four months from the date of cultivation for harvesting and also require frequent irrigation. The plants are harvested when they are in the pod formation stage as the outturn of fibre is satisfactory and the quality good. The plants after harvesting are allowed to dry in 3 days and then tied into small bundles and retting 15 to 20 days according to the local conditions. Over retting makes the fibre weak while under retting makes the fibre coarse as the entire pithy matter and gummy substance will not be separated completely. The fibre contents is 4.5 per cent to 7.5 per cent of the green weight of the stem. The retted plants are beaten with wooden mallet and the fibre is separated from the stem. The fibre is generally used in mills for the manufacture of gunny bags, twine for packing etc.

(VI) *Hemp Fibre* : Sun hemp is also one of the most important cultivated fibre plants. These plants take four to four and a half months from the date of sowing to be ready for fibre extraction. The plants are usually harvested while the plants are in flowering stage but before all the pods are formed. Usually the field is ploughed well after giving soaking doses to the field, in the months of May-June. Then the seeds are broadcasted at the rate of 30 to 40 lbs. per acre. Fortnightly irrigations are given as far as possible till the crop is ready for harvest. For getting better quality fibre the plants are harvested when they are at the pod formation stage and are spread on the field for three or four days to allow the leaves on the stem to fall down. When these plants are fairly dry after the leaves have fallen they are tied into small bundles of about ten pounds weight and steeped into water till these are retted sufficiently. The bundles have to be covered entirely on the top by grass or hay or any available refuse and weighed down. It takes about five to ten days for metting according to the weather and the stage of harvesting. When these are sufficiently retted the bundles are removed from water after rinsing properly and are allowed to dry. The fibre is then extracted either by stripping away the fibrous material by hand or by keeping the retted dried sticks on a log of wood and beating with a wooden mallet.

Harvesting the crop at the dead ripe state gives the highest yield of fibre while harvesting at the podformation stage gives the best fibre,

superior in colour, lustre and strength. The hemp cultivation makes the soil also fertile because the roots which are left in the fields after harvesting the plants contain nitrates and leaves which fall from the harvested plants serve as green manure and all these give additional manure to the soil and make the field fertile.

The fibre extracted from the hemp is used for making twines, fishing cord, ropes, sail cloth, bags, druggests etc.

The hemp fibre produced in Ratnagiri especially Deogad hemp is said to be the best hemp fibre in India.

Cotton : Cotton is the most important cultivated fibre in India. Several millions of people get employment in cotton industry on cottage scale as well as on large scale industry.

Cotton is especially cultivated for fibre purposes. Cotton seed is an important by-product. When the cotton is fully ripe, the cotton is picked up from the plants. The impurities like dust, pieces of dried leaves etc. present on the cotton are removed from the cotton so picked and the fibre is passed through the ginning apparatus which consists of two rollers of about 9″ long and 2″ diameter. In one end of these rollers screw threads are provided and these are so arranged that while turning the handle the two rollers rotate in the opposite direction.

Cotton is inserted through one side turning the handle. The cotton is dragged by the movement of the two rollers in the opposite direction and brought to the other side. The clearance between the two rollers are so narrow that the fibre only passes through and the seeds are thrown to the rear. The fibre is separated from the seeds. Now the fibre is to be made soft for spinning. Softening is done by bow arrangement consisting of a thin bamboo with gut string tightly stretched between the ends. A kind of dum-bell arrangement of 2½″ long with the thinner end 1″ diameter is used as a fulcrum to pluck the string. When the string is plucked with the help of the dum-bell arrangement vibration commences and it makes the dried cotton soft and flufly mass. This process is known as carding. The soft fibre thus obtained is then made into loose rolls with the help of a thin cane or other hard material. This roll of cotton is technically termed as 'sliver', which is taken for spinning on charkhas or tucklies. The yarn thus prepared is converted into cloth, rope etc.

Although there are many large scale factories where ginning and spinning as well as weaving are done by machines. Many millions make their living by working on Cottage Industry Basis.

IMPORTANT TOOLS AND EQUIPMENT USED IN FIBRE INDUSTRY, THEIR SPECIFICATIONS AND THE APPROXIMATE COST

(1) *Willowing Machine* : (*Cost Rs.* 450).

A drum of 6″ diameter and 21″ length is mounted on a stand with the help of a shaft of 1½″ square and 2½′ length. The two stands of 6′×3″ timber and 3′ length are fixed on a frame of 3½′×6″×3″ with cross rafters. The drum carries 8 rows of blades with saw teeth cuts on them for a distance of 4½″ from the top ends. The other end is tapered and fixed

to the drum. Each row has 10 blades. The blades are 9″×1½″×¼″ with a slight bent at the top. One row each of similar blades provided at the top and bottom frame work. The spacing of the blades in the row is 1½″ nett. The clearance between the blades at top and bottom and those on the drum is 1½″ projecting over the bottom of the top fixed blades. A ring of 3/8″ iron rod of 14″ diameter is fixed through the centre of the blades. Hollow tubes to serve as washers and to prevent the blades movement is provided in between two blades. 4 iron rods of 1″ diameter and 3½″ length, two in each side are fixed to support the stand. One flat iron plate of 1/8″ thick, 16″ diameter on either side of the drum is provided to hold the ring with washers inserted through the blades. A grooved pulley is fixed to one end of the shaft. Another wheel of 4½′ diameter with two handles is fitted on a wooden frame for belt drive.

(2) *Rope Making Machine* : (*Rs.* 8.50 *per set*)

One set of thick rope making machine. One mounted on trolley and the other stationary, six pinion wheels of 2″ thick, 6″ circumference having 13 teeth carry hooks of 1½″ diameter and 15″ long with a notch at one end. These pinions are geared by set of three tooth wheels of 15 diameter and 1¼″ thick with 130 teeth, 6″ diameter and 1½″ thick with 40 teeth and 7″ diameter and 1¼″ thick with 10 teeth respectively—. The above mechanism fixed in an angle iron frame of 2½″×2½″×¼″ thick. The dimension of frame 4½′ height from the top circular portion to ground level and 2′ width. Ball bearing adjustment wherever necessary.

(3) *Raspadar Machine* : (*Rs.* 850 *each*)

Drum of 18″ diameter carrying 18 angle steel blades of 8″ long and 1¾″×1¾″×¾″ thick in its periphery mounted on a frame-work of 2½′×1½′ and 3′ height—. Ball bearings on both sides of the axle carrying the drum. An adjustable flat steel blade of 2″×2″ and 8″ long fixed in front of the drum for adjustment of the clearance between the plates on the drum and adjustable blade—. Tooth wheel and chain adjustment for the handle.

(4) *Fibre Carding Machine* : (*Frame costs Rs.* 150¼)

Drum of 18″ diameter. 18″ length mounted on a framework of 30″ × 26″ ×28″ height—Seven rods of 18″ ×3″ × 1″ each with pointed nails fixed on the periphery of the drum—. A wheel of 2½″ diameter fixed to the axle carry the drum which is driven by the driving wheel of 6¾″ diameter fixed to the shaft of the pedal.

(5) *Fibre Spinning Machine* : (Rs. 175)

A flyer of 4″ width having two arms of 7″ length with two movable pulleys in one of the arm fitted on a hollow shaft resting into ball bearings—Fly wheel of 18″ diameter connected to a crank to which a worm of 1″ diameter 2½″ length are fixed below the flayer—. To work give motion to the driving wheels of 6″ diameter fixed to the bottom end of the upright rod carrying the T shaped lever at the top having slot in T—Double groove pulley with locking arrangements to hold the bobbin loosely fitted on the shaft in front of the carrying the flyer.

(6) *Warping Mill* (*Rs.* 850).

A sectional warping drum formed by three wheels of 3½′ diameter mounted on a stand of 6′×4′×3′ by means of an axle of 8′ iron rod of 1¼″ × ½″ on brass bearings. 12 Reepers of 4½″ × 2″ × 1½″ each

21 sections by iron pins of 8″ in each reeper are fitted on the periphery of the three wheels forming the drum. A creel stand of 6′×6′ capable of accommodating 36 spools of 15″×15″ in four compartments, each compartment divided into three parts each part holding three spools. Separate beaming attachment.

(7) *Carpet Loom* : (Rs. 375).

Frame loom similar to cotton weaving loom but the size is of 6½″ × 5½′ with held shaft of 4½′×1½′ 100 Wire healds of 120 gauge in each frame. Reed width internal length and 8″ in height with 30 dents per foot. Iron rod brake with proper tooth wheels mounted on wooden rollers of 12″ diameter.

(8) *Coir Spinning Wheels* : (*Rs.* 100-150).

Stationary wheel has two or more up to 6 spindles of 10″×¼″ diameter 1 or up to 3 spindles. The spindles fixed on the arms of the frame work of 42″ × 48″ or on a circular braket on the arm pulleys of 1¼″ diameter provided to spindles centre wheel of 27″—30″ diameter carrying a handle resting on Bush bearing.

(9) *Straw Rope-making machine* : (*Rs.* 350 *each*).

Two fly yarn making machine consisting of (i) Feeding funnel of 6″ to 18″ long (ii) two twisters of 1½″ diameter mounted on pipe of 1″ external diameter (iii) hair cutter and doubling wheel of 2½′ diameter (iv) drawing rollers of 1¼″ diameter ×2″ length including a wheel (v) yarn guide of 10″ (iv) winding drum of 15″ diameter one end fitted on Ball-bearing adjacent (vii) 2 Pedals of 24″ length attached to two crank wheels of 9½″ diameter.

(10) Minor tools like garden scissors, tailor scissors, flat knives, pliers, winding charkha, needles, pocker etc. of ordinary type as well as dye vats (copper basins) welded at the joints, weighing balance etc. are also required.

TOOLS AND EQUIPMENTS USED IN FIBRE INDUSTRY AND THEIR WORKING

Raspadar Machines

This consists of a drum on which horizontal blades are fitted on its periphery and a plate is fixed in front of the drum. The plate is adjustable and the clearance between the adjustable plate and the blades in the drum can be adjusted to suit the requirement or the thickness of the material which is to be fed through it for extraction of fibre The machine can either be worked by hand or on power. A man takes two to three leaves at a time and feeds these in the machine inserting the tip end of leaves first into the clearance of the Raspador holding butt end tight. When the machine draws in the leaves to the extent of 3/4 of their lengths they are pulled back. The butt end is then inserted in between the clearance allowing the butt end to be decorticated. As some time is wasted by the person to pull the fibre it is advantage for 2 persons to work alternatively while the first person is engaged in removing the fibre already decorticated from the Raspador the other man can start feeding fresh leaves and before he completes his operation the first man will be ready with material for decoration and repeating the process. Thus the machine does not remain idle.

The fibre thus decorticated from the Respador machine contains pith etc. in loose condition. In order to eliminate all such impurities the fibre is soaked in water for five to ten minutes till the green pigment present in the fibre is removed. It is then kept on a stone and beaten with a wooden mallet and washed well. The fibre is allowed to dry either by hanging on a support or spreading on the floor-when it is well dried it is combed and packed into bundles.

The following equipment are now in use on cottage industry basis for converting hard fibres into yarn :

(a) Coir spinning wheels.

(b) Spinning machines with feeding funnel adjustment.

(c) Fibre spinning machine with automatic winding.

(a) *Spinning coir spinning wheels.*—This consists of a stationary wheel having two or more spindles and a movable spinning wheel having one spindle. The spindles are fixed on the arms of the frame work of the wheel. These spindles carry a pulley each at the centre and a string is passed on to these spindles and over the wheel. When the handle or the wheel is turned the string on the wheel turns along with the wheel making the spindles move and thereby imparting twist to the fibre lead on the spindles. Coir spinning wheels are the best cheapest suitable equipment for converting coir fibre into yarn on cottage Industry basis and they are extensively used all over the areas where as coir industry is in existence in India.

(b) The fibre extracted from the retted husk is passed through a willowing machine for softening. The fibre passed through this machine is cleaned well and the fibres are laid more or less parallel removing the last pith contained in them. These are then rolled into small rolls after moisting them with little water. These rolls of fibre are technical termed as 'Slivers'.

Two or more persons according to the required number of plies for a yarn take the sliver and keep them under their armpit. They then give a loop to a small quantity of fibre and put the loop on the notch of the spindles and slight motion is given to the stationary spinning wheel. The fibre is lead to a uniform thickness walking backwards. The fibre thus lead is given twist by turning the spinning wheel by a girl or boy. This operation is continued till the required length of the ply is reached. These plies are passed through a grooved rod and tied together into the notch of the spindle on the movable wheel. Now the stationary wheel is turned as fast as possible and the grooved rod is moved towards the stationary wheel while the movable wheel is turned in the opposite direction. The object of the grooved rod is two fold. It regulates the twist of the yarn and also it prevents entanglement of the plies. When the grooved rod reaches the stationary wheel all the plies from the stationary wheel are removed from the spindles a knot is given. Then the yarn is tested to find out whether it contains enough twist. If the twist is more than required the movable wheel is turned in the opposite direction of its original turning and if the twist is less the wheel is turned in its original direction till it is seen that the yarn attains the actual twist required. This yarn is then reeled into small hanks for packing and transport to coir factories where it is converted into mats, mattings, ropes, bags, ets.

Spinning Machine with Feeding Chutes Adjustments

This machine is known as two ply rope making machine. This is usually operated by foot but can be worked on power as well. This machine consists of the following parts.

1. Two feeding chutes or funnels.
2. Twisters.
3. Doubling wheel.
4. Drawing rollers.
5. Yarn guide.
6. Winding drum.
7. A pedal adjustment.

Hard fibres preferably with long staple like sisal munj straw are spun into two-ply thick and thin yarn by using this machine. The material is first inserted by hand into the feeding funnel and pushed through the eye of the twisters with the help of a wire till the end of the material is caught in between the drawing rollers. The machine is then rotated by hand to impart twist to the material. Feeding is continued through the two funnels uniformly and the machine is started by treading on the pedal. The fibre thus fed is given individual twist by the twisters attached to each funnel and is passed through two eyes (holes) which act as the regulators of the twist when the strands pass through these holes. Both the strands are twisted together by the movement of the drum which is in the rear to carry the yarn thus spun.

As the yarn gets sufficient twist, it passes through a guide and is automatically wound on the drum which is fixed in the machine. The guide is so adjusted that winding is uniform. About 500 yards of yarn of ¼" thickness can be wound on the drum.

The advantage of this machine is that a single person can work on it to have a two-ply yarn while three persons are required for making a two-ply yarn in a coir spinning wheel, and at the same time much space is not required to work on this machine. This machine is suitable for spinning hard fibre with long staple pliable material.

Fibre Spinning Machine with automatic winding

This machine consists of a flyer fitted on a hollow shaft resting into brass bearings which are mounted on a wooden pedestal which can be swung out. This pedestal is locked by means of a wooden lever. A pulley is attached to this shaft to allow it to be driven by means of a rope passing over the driving wheel which is operated by a crank and pedal. A worm is fitted on the crank shaft. The worker turns the wheel fixed to a vertical shaft. The top of the vertical shaft is fixed to a crank which gives to and fro movement to the 'T' shaped lever by means of a crank pin through the slot in the 'T' shaped level. An upright arm is bolted to the 'T' shaped lever with a crescent shaped fork at the top.

A shaft fixed to a wooden block centrally in front of the flyer shaft. A reel which could be attached easily to the pin to fix the notch of a reel to the pin in the pulley is inserted on the shaft. The reel is guided by the crescent fork on the upright arm mentioned above through one of the grooves of the pulley. A weight is suspended by means of a wire on the other groove and it acts as a brake. The weight on the wire has to be changed according to the thickness of the yarn. The action of the brake of the wire on the pulley retards the motion of the reel which in turn drags

the yarn in. The axis of the flyer shaft and the fixed shaft carrying the double grooves pulley are in the same straight line and the clearance between the inner ends of the two shafts is about one inch.

To start the work, a thread is first lead through the hole of the hollow shaft and passed through the guide pulleys and the pulley and the flyer and tied on to the reel which is locked to the double groove pulley. The machine is then started after giving a slight motion to the driving rope in the proper direction according to the twist. Subsequently piecing up of fibre to the end of the thread with the right hand is continued. The fibre thus fed through the hole is given twist by motion and the yarn is formed. The yarn thus spun is wound on to the bobbins automatically. The 'T' shaped lever gets to and fro movement when the machine is in motion making the reel locked to the pulley and enabling uniform winding of the yarn on the bobbin. The weight suspended on the wire is to be increased or decreased according to the requirement of twist. If more twist is to be imparted, the weight should be decreased and vice versa. The pulley on the flyer shaft can be changed according to the requirements of the speed of spinning.

Doubling Machine

The mechanism and working is more or less same as that of the Fibre Spinning machine. But the difference is that the doubling machine has one additional framework to hold two or three bobbins with yarn which is to be converted into two or three ply and a guide rod having grooves on three sides. Instead of feeding the fibre in the Fibre Spinning machine, the bobbins with the spun yarn are kept in the space provided for the bobbins. The yard from these bobbins are taken through the guide rod and on to the empty bobbin through the flyer. Counter twist is given to the two or three ply yarn and the yarn automatically is released and after counter twist it is wound on to the other bobbin. This machine costs Rs. 25 more than Fibre Spinning machine, i.e. Rs. 200.

Fibre Carding Machine

Before the fibre is taken for spinning on fibre spinning machine, it is necessary, to soften it. For that purpose the fibre such as sisal and sun hemp is treated on this machine. This machine has a drum which carries blades with pointed nails on them. It is worked on pedal system. The fibre fed through one side of the machine is dragged forward by the drum while it is in motion. The fibre thus drawn in, is carded and thrown to the other side one over the other more or less, in parallel, layers. This fibre is then rolled into slivers which are spun into yarn subsequently.

Willowing Machine

It is extensively used in places where coir industry is carried on. This machine consists of blades with saw teeth cuts and fixed to the drum and in the frame-work as explained in the specifications. This machine is used for carding the coir fibre. This machine serves the same purpose as that of the fibre carding machine in carding coir fibre only.

Rope Making Machine

In practice, the machine for making a two-ply rope is known as spinning machine. In some cases it is called as Baco rope making machine or straw rope making machine, etc. Really speaking, the machine used for

making a thick rope is called a rope making machine. In order to avoid confusion, it is desirable to term it as 'Thick rope making machine' for the machines used for the manufacture of cordage or thick ropes of three or more strands.

2. To make strong ropes, it is advisable to use a number of thin yarns made on spinning machines and divided into any number of equal parts as per the requirements of the strands of the rope, one end of the strands is tied to each hook of the stationary rope making machine and all the other ends are tied to the central hook of the movable machine after imparting sufficient twist to the individual strands. When the maximum possible twist is imparted to the strands the strands are passed through a grooved rod, (or guide) from the movable machine and is slowly moved towards the movable machine till the grooved rod reaches the stationary machine. The stationary machine is turned into its original direction and the movable machine imparts twist to the rope in the opposite direction. When the rod reaches the stationary, machine, all the strands from the individual hooks of the stationary machine are cut off and given knot after removing the rod. This rope is then coiled and packed for disposal.

Dyeing

Dyeing is carried on in fibre industry to have attractive designs. In order to dye the fibre or yarn the water in a dye vat is boiled v[illegible]. The water should be sufficient enough to immerse the entire quantity of [illegible] fibre material. Dyes according to the requirement *i.e.* ½% to 5% of the weight of fibre is taken to a small basin and mixed with water. This solution is carefully transferred to the boiling water. It is very essential to see that the dye stuff is well dissolved. Then the fibre or the yarn is put inside the dye bath and the material turned upside down. Repeat material. Again boil it and keep the material till the water cools preferably overnight. The next morning the material thus dyed is allowed to dry preferably in shades. This is then converted into carpets, matting, fancy articles etc.

Warping Mill

In order to prepare the longitudinal threads for the matting and carpets warping mill is used. The longitudinal thread in the fabric is known as warp.

The warping mill consists of (1) a creel; (2) a rear rod; (3) a converging reed; (iv) Leasing reed and (5) section reed.

A comb on the other side of the section reed.

First the yarn is found on the warpers, bobbins or spools. When sufficient number of spools are wound, they are placed in the creel which has three rows of four compartments. In each row there are three sections. Thus in a creel used in hard fibre industry, there are 36 sections.

The warp ends from the spools in the creel are drawn and passed individually through each dent of the rear reed and then through the converging reed. Then these reeds are taken through a leasing reed. Then the entire band of yarn is taken through the section reed and a knot is given to the band of yarn and is secured to a peg of one section block. Then the drum is allowed to be turned till the required length of the warp is wound on that section. When the required length of the warp is wound on that

section, a leasing thread is introduced and then the ends are cut off and knot is given. The second section is then prepared likewise. Similarly this process is repeated till the required sections are wound on to the drum. When sufficient number of sections are wound on to the section block, leasing rods are introduced through the leasing thread and the warp ends are then taken through the dents of the comb in groups of three or four and ends tied to the warp roller. After winding the warp on the roller it is taken to the loom for weaving operation.

Weaving Process

Weaving is the art of making a fabric by inter-weaving the distinct sets of yarn. Those passing longitudinally from end to end of the fabric are known as 'Warp' and those crossing the warp at right angle which is known as weft of pick. In early days the cloth was made by the interweaving of grasses, bark, leaves and similar materials. The discovery of spinning made possible the production of continuous thread from animal and vegetable sources which were admirably suited for the purpose and thus the usefulness of the production was considerably enhanced. In ancient times weaving was carried on just like mat weaving. But now pit looms, handlooms and hand-powerlooms and automatic looms are used.

Pit looms and handlooms are used for the preparation of matting carpet, Bordrees etc. In order to weave a fabric the warp ends require shedding operation. For this purpose the warp is to be prepared and is to be beamed on the warp and then taken to the loom. The warp ends are to be drawn in through the eye of the healds individually. Usually the healds are distributed on four pairs of healds shafts and are hung in front of the loom just behind the frame carrying the reed. The frame carrying the reed is technically termed as sley. The operation of drawing in through the healds is known as healding. The order of healding for a plain weave on 4 pairs of healds shafts is 1, 2, 3, and 4. After drawing in all the warp ends they are again taken through the dents of the reed usually in twos. Then the reed is fixed to the sley and the ends are tied to a stick which is suspended on the cloth roller.

The heald shafts are hung on two sets of levers or a roller at the top of the loom behind the sley. Now the heald shafts 1 and 2 pairs are tied to a treadle and the 3rd and 4th pairs are tied to the second treadle for plain weave. The weft is then inserted through each shed obtained by treadling the treadles one after the other. The effect of this weaving is plain. For weaving designed fabrics the healding and treading operations are to be changed as per designs.

First the order in which the warp and weft ends interweave in a fabric are to be drawn on a design paper. Usually the vertical lines in the design paper are shown to represent the warp and the horizontal parallel lines to represent the weft. The designs are indicated either by filling weft floats or warp floats on the design paper. The blanks in either case represent the opposite of what the marks indicate. A plain weave is indicated on the design paper by filling all the alternate squares in the design paper and in this case it is clear that all the alternate ends are to be raised up for every pick and lowered for every other alternate pick. In other words the threads inter-lace in alternate order.

Designs up to eight treadles are usually woven on handlooms for heavy fabrics like coir matting but in cotton weaving designs up to sixteen treadles are woven on ordinary handlooms. As the number of heald shafts and

treadles increase the treadling operation becomes heavy and the tie ups also become complicated. To eliminate these difficulties dobbies are used for complicated designs having more than eight treadles and for designs beyond the scope of dobbies Jacquard machines are used.

Bags are prepared either by manufacturing braids or taking the woven fabrics into the required size and stitching the ends.

(i) *Braid Bags*

The fibre is first dyed to the required taste of colour and the fibre is allowed to dry when it is sufficiently dried it is combed well. The combed fibre is then plaited into braids of three attractive colour. This kind of braiding work is mostly done by women folk. The braid thus prepared is stitched into the form of bags and the handle is attached. Cotton cloth is provided as the lining of such bags.

Woven Bags

The matting of carpet or other fabrics already woven is cut to the required size and shape of the bag. The three ends of the fabric are stitched together to make the bag. Both the ends of the fourth side are to be stitched properly. Thus a pair of handle is attached to the open side. The preparation of this kind of bag is easier than the preparation of braid bags and hence cheaper than the braid bags.

Weaving on Stools or Door Frames

First the stool or the door frame is to be taken out and the yarn is tied on one of the short frame and the warp is prepared by taking round the similar short frame on the opposite side as close as possible but without overlapping when the warp is thus prepared another yarn is taken and is inserted into the warp by raising every alternate warp and lowering the other alternate warp and is taken round the long framework. Then the yarn is taken back by raising all the warp ends which were lowered for the previous weft and by lowering the other alternate warp. When it reaches the starting point, the process is repeated till the complete portion is woven in this way and finally a kud is given.

SYLLABUS ON COIR FIBRE WORK

Duration of the training—6 months

Theoretical	Practical exercises
1. Various tools and equipment—their names—uses and maintenance.	
2. Process of retting—extraction of fibre—cleaning of fibre.	Soaking—retting—extraction process.
3. Methods of spinning—hand spinning—wheel or charkha spinning—spinning with improved type of spinning—advantages—relative efficiency —willowing of coir or willowing machine.	Spinning yarn by hand spinning method—wheels—improved devices willowing operation.
4. Process of rope making with single ply—double ply yarn—by hand tools and rope making machines and cordage making.	Preparation of single ply rope yarn—doubling of single ply yarn on doubling machine—use of Japanese or Ludhiana type of rope machine—Preparation of cordage—braids.
5. Methods of bleaching and dyeing ..	Bleaching of fibre—dyeing of fibre.
6. Preparatory process for weaving, making of mats. Sorting, washing for removal of salts —drying —splicing—spooling—section warping—beating.	Splicing of coir yarn—spooling of coir yarn—warping on sectional warping machine—Designing on square paper and actual production of these designs on looms.
7. Principles of making or weaving mats—Rod mats—Creel mats—fibre mats.	Weaving of rod—creel and fibre mats on looms. Finishing of mats *viz.* (*i*) tying (*ii*) squaring (*iii*) binding braiding (*iv*) braiding (*v*) shearing (*vi*) trimming (*vii*) stoving—bleaching.
8. Principles of finishing—squaring—lying—binding—bleaching and packing.	Finishing of rod—creel, fibre mats—Rotmas—stencilling—drying and packing mats—creel drying and packing. Fibre mats—levelling edges of designs and packing.
9. Costing—estimating of different products, marketing and cooperation—principles—benefits organisational procedure—duties and rights of members of cooperative societies. Books of accounts and registers and manner of their writing in brief.	

SYLLABUS FOR TRAINING IN COIR INDUSTRY

Note :

(i) It may be noted that no division in details regarding the practical and theoretical lessons is made for the following reasons :

(a) On account of the educational qualifications prescribed for the trainees it is very doubtful as to how much they will benefit from theoretical lessons given separately from practical lessons.

(b) The trainees will be able to understand the things better while instructions are given for the practical classes and the instructors actually demonstrate the working of the machines.

(ii) It is also felt that before instructors take charge of the classes and are in a position to give instruction to the trainees they should undergo practical training in Coir factories as well as roperies and also in some spinning centres. This will enable them to demonstrate the working of the various machines properly and explain the working clearly to the trainees.

(iii) It may be noted that there do not seem to be any regular indigenous manufacturers of the various machinery used in the Coir Industry. As such no detailed drawing and/or specifications are available. The equipment as and when required are got manufactured from local craftsmen by showing them similar equipment present elsewhere or according to the specifications given by the parties giving the order. Regarding the availability of the Japanese type of Coir Spinning Machines, the necessary information may be obtained from the Secretary, Coir Board, Ernakulam.

(iv) The prices of the various equipments and machinery are only approximate and are intended to give only a rough idea of the financial outlay involved.

The syllabus for the training may be as follows :

Brief theoretical description of : (a) the various processes of—(i) retting, (ii) extraction, and (iii) cleaning of the fibre; (b) the methods of—(i) hand spinning, (ii) spinning the wheel or Charkha or Ratt, (iii) Spinning on the Improved Type of Spinning Machine; (c) the preparatory processes including—(i) sorting, (ii) washing for removal of salt, (iii) drying, (iv) splicing, (v) spooling, (vi) section warping including beaming; (d) principles of the handloom, its construction and operation, (e) the principles involved in the weaving or manufacture of the three important types of mats, *viz.*, Rod Mats, Creel Mats and Fibre Mats; (f) finishing operations for the various mats mentioned above (*viz.* squaring, typing, binding, bleaching and packing); and (g) principles involved in the dyeing of coir fibre and coir yarn and the general methods of application of various dyes commonly employed for dyeing coir.

The details of the syllabus are given in the following pages.

LESSON NOTES FOR PRACTICAL CLASSES IN COIR FIBRE WORKS

For practical classes :

(i) Extraction of fibre from retted husks, if available locally. Otherwise the coir fibre may be purchased and utilised for spinning.

(ii) Spinning of yarn by the hand spinning method.

(iii) Spinning of yarn on the improved type of spinning machine (pedal operated).

(iv) Spinning of yarn by the spinning wheel.

(v) Dyeing of coir fibre and coir yarn with the usual classes of colours used on coir.

(vi) Slicing of coir yarn.

(vii) Spooling of coir yarn.

(viii) Warping on sectional warping machine. Designing on square paper and actual production of these designs on looms.

(ix) Weaving of Rod, Creel and Fibre Mats on Loom.

(x) Finishing of Mats *viz.* (i) squaring, (ii) tying, (iii) binding, (iv) braiding, (v) shearing, (vi) trimming, (vii) stoving—(bleaching).
[Finishing of : (i) Rod, (ii) Creel, (iii) Fibre Mats, items (i) to (vii) are common).]
Rod Mats—Stencilling, drying and packing.
Creel Mats—Drying and packing.
Fibre Mats—Bevelling edges of designs and packing.

I. *Retting of Husks* :—

The fibre (coir) is extracted from the husks of 11 to 12 month old nuts. The nuts are dehusked and the pieces of husks are soaked in the water to soften, and/or loosen the cementing material. The best method for extraction is found to be soaking or retting method followed in Kerala. Below are summarised the three methods usually followed in Kerala.

(a) Basin shaped pits are dug within the reach of the gentle tidal action of the backwaters. The bottom of the pits/may be naturally sandy or the bottom may be specially covered with sand and the sides lined with coconut leaves. The husks are placed in these pits and weighted down by covering with coconut palm leaves and mud. This prevents the floating of husks when water flows in.

Alternatively channels may be provided to allow flow of water into or out of the pits with the rise and ebb of the tide.

(b) In this method enclosures are built in shallow backwaters with bamboo stakes and coconut leaves. The husks are placed in these enclosures and weighted down with coconut palm leaves and mud as mentioned in the first method.

(c) There is a third method which is in vogue in the Anjengo Area in the former Travancore-Cochin State and in Ponnani Area in Malabar. In this method the husks are placed inside large coir nets to form floating Islands. These are kept floating in backwaters for a few days and then weighted down with coconut palm leaves and mud, so that they slowly sink to the bottom.

It may be noted that the best fibre is obtained from fresh husks from 11-12 month old nuts and which are put for retting within a few days of husking.

II. *Extraction of fibre*

The retting process takes six to ten months depending on various conditions. The retted husks are taken out and washed to remove the adhering mud and slime. The outer skin is then peeled off. The washed husks are then put on wooden platforms or flat stones and beaten with, wooden mallets and until most of the pith and dust is separated from the fibres. After this, the fibre is cleaned by hand or washed a second time and then lightly beaten to separate the pith and dust still adhering to the fibre. The fibres are then dried in the shade and further cleaned by willowing. The willowing may be done by hand or by a hand operated willowing machine.

[NOTE : Where retting facilities as described are not available, the husks are sometime soaked in water from a few hours to a couple of weeks and the fibre extracted by beating as in the case of retted husks. Such fibre carried quite a good deal of pith and darken easily on exposure to air.]

III. *Spinning*

These may be divided into three classes : (i) Hand Spinning, (ii) Spinning on wheel or Charkha and (iii) Spinning on Japanese Type of Spinning Machine.

(i) *Hand Spinning*.—In this case the fibre are rolled into short lengths of 6 to 10 inches by giving a clockwise twist with the hand. When a sufficient quantity is made, two of these short lengths are taken in hand together and made into a two-ply yarn by giving a counter twist. When the counter twist reaches the end of the string further lengths of short pieces which are kept are added while the counter twisting by hand is continued. When the required length (20 to 50 ft.) is reached the yarn is reeled in the form of a hank and a knot is made at the end. Hand spun yarn has always a soft twist. However, hand spinning is going out of vogue as machine spun yarns yield a better return to the spinner. A woman can spin about 4 to 5 lbs. yarn in 8 hours a day, whereas a team of three can turn out about 25 lbs. of yarn on the spinning wheel.

(ii) *Wheel Spinning*.—For this purpose a set of two wheels one stationary and the other movable are required. The stationary wheel carries two spindles set in motion through the central wheel. A handle for turning is inserted through the centre of the wheel. Slivers of the fibre. Each then by two workers (usually women) who keep the fibre bundle in their armpits. They make a loop with a small quantity of the fibre. Each then

attaches the loop thus made to the notch of one of the spindles on the stationary wheel and gives the fibre a uniform thickness. The third worker now rotates the wheel which in turn rotates the spindles thus imparting a twist to the fibre. As the wheel is being rotated, the two spinners deliver fibre in required thickness, walking backwards till the required length of strand is reached. The two strands thus obtained are passed through a grooved rod and tied together to the notch of the spindle of the movable wheel. The movable wheel is then rotated to give a counter twist and one of the spinners moves with the grooved rod towards the stationary wheel. As the wheel rotates, the two strands of the yarn are twisted together. The grooved rod is for regulating the twist of the yarn and prevent entanglement of the strands at the time of twisting. During the twisting of the strands into 2-ply yarn a shortening in length takes place and therefore the movable wheel has to be moved a short distance towards the stationary wheel. When the grooved rod has reached the stationary wheel the turning of the wheel is stopped. The ends from the stationary wheel are then cut off and the yarn is then reeled into the form of hanks of about 50 ft. long. On the average in an eight hour working day 3 persons are capable of producing about 25 lbs. of yarn. The main disadvantage of the spinning wheel is that a lot of space is required for the spinners to move back from the stationary wheel. This can be obviated by the use of Japanese type of spinning machine.

Rope making

This is done on a pair of machines which are similar to the spinning wheels described above except that the stationary wheel contains two or more hooks geared together.

To make strong ropes, a number of thin yarn strings of the required thickness are cut into equal lengths as per the required strands of ropes. The ends of all these strands are tied to individual hooks on the stationary wheel and all the other ends are passed through the grooved rod and then tied to one hook on the movable wheel. A new twist is given to the individual strands by turning the handle of the stationary wheel. When sufficient twist is imparted to the individual strands, the movable wheel is turned in the opposite direction and the grooved rod moved forward till it reaches the stationary wheel. The strands are then removed from the hooks and a knot is made after the grooved rod is taken away.

(iii) *Spinning on Improved type of spinning machine.*—In this machine the spinning of the single strands and the conversion of the two single strands into a 2-ply yarn is carried out consecutively and the 2-ply yarn is continuously carried on to a spool. This is operated by a foot pedal. The two spinners with slivers of coir fibre stand near the machine and one of them operates the foot pedal. To start the process a small length of strand is hand spun by each of the spinners and the strands are threaded through the machine and tied to the winding spool. Then the machine is started by operating the foot pedal. It is reported that on this machine two workers can produce about 18 lbs. of yarn per eight hour shift.

Varieties of Yarn

The coir yarn is divided into a number of categories. The descriptions are mainly based on the localities where they are produced. Each locality seems to have developed special skill and processes, giving the yarn produced certain special characteristics.

1. *Anjengo.*—Completely wheel spun yarn and hand twisted. This variety is largely used for manufacture of nets and mattings.
2. *Mangadan.*—Which is wheel spun is produced in the northern areas of Quilon. It is largely used for making ropes.
3. *Caruva.*—Locally called as Ashtamudy is found around the lake of Ashtamudy. Small quantities are used for rope making.
4. *Alapat.*—Hand and wheelspun is of hard and even twist and bright butter colour found largely in Karunagappally Taluk.
5. *Aratory.*—Aratory is wheel spun, found in the southern areas of Alleppey and largely used for manufacture of mats and mattings.
6. *Vycome.*—It is spun around Vycome. Both hand spun and wheel spun with uneven surface, used for manufacture of mats, mattings and ropes.
7. *Beach.*—It is spun in places between Shertallai and Ernakulam and is entirely hand spun and used for making the low quality of door mats.
8. *Roping Yarn.*—Roping Yarn is thick coir, entirely hand spun in Malabar, Cochin and Kayangulam areas and chiefly used for rope making.
9. *Quilandy.*—It is entirely hand spun, very thin and regular coloured, found around Kozhikode, Quilandy and Feroke. A small quantity is used for rope making.
10. *Beypore.*—This is entirely hand spun, containing usually more pith and produced largely in Beypore and Calicut. A small quantity is used for rope making.

Preparatory Processes

These are processes carried out prior to weaving and include :

(i) Sorting, (ii) Washing, (iii) Splicing into longer lengths, (iv) Dyeing of coir yarn and fibre (v) Spooling and (vi) Warping.

(i) *Sorting.*—The yarn is sorted out according to cleanliness, free from pith and other impurities, evenness of twist, colour etc.

(ii) *Washing.*—The yarn is washed by dipping in water to free it from salt.

(iii) *Splicing, Spooling and Warping.*—The yarn comes in hanks of about 50 ft. length and a number of such hanks are spliced together to give longer lengths. With the help of a hank stand the hank is wound on spools. A spool can hold up to about 1,200 yards of yarn.

As many spools as are required are arranged on a creel kept at a distance from the sectional warping machine. The Sectional Warping Machine consists of a drum about five yards in circumference. Its surface is covered by strips of wood parallel to its axis on which long nails are fixed so as to form parallel rows both axially and circumferentially. These nails serve as guides and help to keep each section separate. The yarn from the spools is taken through a loose reed and tied on a hook provided on the warping drum of the machine. The loose reed is capable of being

moved or slided on a rail kept parallel to the axis of the drum. This helps in keeping the yarn straight when it is being wound on the warping drum. This also prevents the yarn from the various spools from getting entangled. The cylinder is rotated manually. After the necessary number of sections have been wound on the warping drum, they are transferred to the weavers beam in the usual way. The tension on the yarn while winding from the warping drum to the weavers beam is maintained by putting a restraint on the formers rotation by a pair of leather straps taken round the circumference of the cylinder, ends of which on one side are attached to springs bolted to the ground. The free ends of the belts are attached to heavy weights which hang freely. A number of weavers beam may be prepared from the yarn on the warping drum. This will be regulated by the yardage on the drum and the yardage required per beam. The looms used in the coir industry are similar to the handlooms used in the cotton weaving. But the framework, sley, reed, healds, etc. are much stronger than those used in cotton weaving. As weaving of matting is considered normally as a small scale industry and not as a cottage industry, no training in weaving of mattings need be given to them.

Weaving of mats on loom

The syllabus requires division under three heads covering the three principal types of mat weaving, *viz.*

(a) Rod mat : pile : weft induced.

(b) Creel mat : pile warp induced.

(c) Fibre mat.

(a) *Rod Mats.*—The weaver's beam is placed at the back of the loom. The warp is passed over the back rest, through the healds and reed and passing over the breast beam, and is tied on a rod. The ends of this rod are attached to a wooden roller by means of pieces of rope. A ratchet wheel is attached at one end of the wooden roller by working on which, the woven material can be taken away from the weaver and rolled up. The tension to the warp is adjusted by operating a ratchet wheel fixed on the weaver's beam.

In the case of rod mats the brush is formed with topping or punja yarn. This yarn is prepared by taking two or three yarns together. The proportion of the topping yarn to the weft yarn can be varied to suit a quality. The topping yarn is of the soft twisted variety which will help in getting good brush. The brush heights in the mats having the same proportion of topping and weft yarns can be varied by using rods of different thickness. The rods made use of in the construction of mats are flat grooved steel bars. The bar is put over the warp ends across the mat and the topping yarn is taken through the shed and wound spirally over the rod along with alternate ends of the warp. Thereafter a single weft has been inserted through the same shed, the sley is beaten fast to allow the weft to get close to the fabric. After changing the shed by threading a knife is passed through the groove of the iron rod facing upwards. The process is continued.

In the case of fibre mats, the piles of fibre are inserted by hand into the warp according to the design, one by one, and when the fibre has been inserted to all the alternate warp ends, a weft yarn is inserted through the same shed and the sley is beaten to the fabric already woven. Now the fibre

is cut to the required height. Then the fibre is inserted to the other alternate ends as before. For designed mats, coloured coir fibre is inserted according to the design. When the mat is removed from the loom a braid is stitched all round the mat and is trimmed by a scissor.

Unlike the mats mentioned above, this variety of mats—creel—has got the brush made from the warp yarn itself. One of the two chains meant for the brush must be of longer length. Also this variety of mats require two grooved rods usually of thinner size. One of the rods is inserted in the shed when the loose chain comes up. During the formation of the next two sheds, the weft yarns are inserted. The second rod is to be placed in the next shed. It is only now the first rod can be taken out by passing a sharp knife through the groove of the rod. Otherwise all the wefts will be left loose without being properly held up.

Finishing Operations

Squaring.—A process in which the size of the mats are made to the standard

Tying.—This is a process by which all the loose ends are tied and embedded to the body of the mats.

Braiding.—Here the braid is put all around and stitched.

Shearing and trimming.—These are to be done by scissors as the machines for the purpose are beyond the scope of the artisans.

Stoving.—This is done to give a bright colour to the mats. This is done by heating a mixture of sulphur and alum in a closed chamber in which the mats are packed. It is doubtful whether this can be done on a cottage industry scale.

Stencilling.—This is another process in which the mats are given beautiful designs. In order to get good effects the stencilling must be done with the help of a compressor and a sprayer. This is also doubtful whether this can be adopted in a Cottage Industry. Stencilling may also be done by brushing but this does not give as good an effect as spraying.

Element of Costing

Costing is the operation of calculating the cost of an article for sale as a basis upon which the selling price may be fixed. Costing is the proper allocation of expenditure selling and distribution.

For practical purposes costs are best considered under three headings of labour, material and other expenses. Labour costs consists of the remuneration paid for people's work namely wages and salaries plus certain other charges directly related to the employment such as insurance, pension costs and welfare expenses.

The object of material costing is to find the value of material used on a job, process or unity cost, with a view to controlling expenditure on material in relation to output and to assist in price fixing and estimating.

Because the allocation to units of variable and fixed charges largely depends on turnover, it is essential that unit costs be expressed in :

1. variable costs including direct wages cost of material, and other direct expenses and also,
2. the fixed costs including staff salaries, rent of premises, cost of equipments and machineries and depreciation.

List of equipment and machinery with approximate prices

1. Wooden Mallets, Platforms and sets (three sets).
2. Iron Mallets (three).
3. Hand operated willowing Machines (one).
4. Spinning Wheel, Ratt or Charkha for spinning yarn (one set). Additional hooks may be provided on the stationary wheel so that the same set may be used for making ropes.
5. Improved Type of Spinning Machines (Sponsored by the Coir Board) (one set).
6. Conical Hank stands (six).
7. Spooling Machines (six sets & six spare spools).
8. Section Warping Machines (with creel).
9. Three looms (with accessories) one for each type of Mat :— (i) Rod Mats, (ii) Creel Mats, and (iii) Fibre Mats.
10. Shearing Scissors (3 Nos.)
11. Small Scissors (3 Nos.)
12. Long Scissors for trimming fibres during weaving (3 Nos.)
13. Needles for stitching.
14. Two copper tubs for dyeing (to be heated by fire wood) and accessories such as weighing scales, mugs, etc.

Approximate cost of above items

	Rs.
1. 3 sets @ Rs. 10 per set	30
2. 3 Nos. @ Rs. 5 each	1
3. Willowing Machine—One No.	400
4. Two sets @ Rs. 100 per set	200
5. Two sets @ Rs. 150 per set	300
6. Six sets @ Rs. 5 per set	30
7. Six sets and Six spare spools	90
8. One set—Warping Machine	1,000
9. Three sets @ Rs. 150 per set	450
10. Three Nos. @ Rs. 15 per each	45
11. Three Nos. @ Rs. 6 per each	18
12. Three Nos. @ Rs. 15 per each	45
13. Needles for stitching	—
14. Tubs, Scales, mugs, etc.	500

Normally coir fibre or yarn is dyed with dye-stuff of basic, acid or direct class. Practically all basic dyes are suitable for application to coir and are extensively used. Many acid and direct dyes do not possess sufficient affinity. When brightness of shade is the main consideration obviously choice

choice is the basic dye. Basic dyes give high tintorial value on coir. However, the light fastness is rather poor. For somewhat better light fastness with a reasonably light shade selected acid dyes are of interest.

Acid dyes are particularly useful in the production of red and scarlet shades, on account of their good affinity and good light fastness. The tintorial value of acid is less than that of basic dyes.

Direct dyes are employed where still higher light fastness and superior water fastness of dyeings are required. However, direct dyes have a range to produce duller shades.

Pretreatment of coir.—Normally coir is not subject to any wet treatment before dyeing.

General notes on dyeing

1. Basic dyes are made into a paste with a small quantity of cold water and an equal amount by weight of acetic acid (30 per cent). Hot water is then added with stirring. The stirring is continued till the dyestuff is dissolved. In the case of Auramine O, the temperature of water used for dissolving should not exceed 70°C.

Acid and Direct Dyes

These are made into paste with cold water and dissolved by the additions of boiling water with stirring.

2. All percentages are calculated on weight of coir (fibre or yarn). Any convenient material to liquor ratio of 1 : 20 to 1 : 40 may be used, though 1 : 20 is probably the most common. The material to be dyed is entered in the dye bath at about 50°C and the liquor is gradually raised to their appropriate temperature. The material is usually agitated during dyeing to obtain uniform shades. The dyed material is rinsed in cold water and dried.

3. *Application of various classes of dyes*

(i) *Basic Dyes.*—The dye baths contain the necessary amount of water and the previously dissolved dyestuff with 2 to 5 per cent of acetic acid (30 per cent). The material is entered into this bath at about 50°C and raised to 90°C and the material is dyed at this temperature for one hour. In the case of Auramine O, however, the temperature of the dyestuff should not exceed 70°C.

(ii) *Acid Dyes.*—The dye bath is made up with requisite amount of water, previously dissolved dyestuff and 3 to 5 per cent of formic acid (85 per cent). The material is entered at about 50°C and the dye bath is raised to boil and the dyeing is continued at the boil for one hour. With certain dyes the formic acid may be replaced with 3 per cent potash alum as it is said to yield a better colour value. The potash alum should however be added only after the dye bath has reached the boil, otherwise the dyestuff may be precipitated.

(iii) *Direct Dyes.*—The dye bath contains the necessary amount of water, the previously dissolved dyestuff and 10—20 per cent dessicated glauber's salt, according to the depth of the shade. The dessicated glauber's salt may be replaced by an equal quantity of common salt. The material is entered at 50°C, the liquor raised to boil and continued dyeing for 1—1½ hours.

FIBRE INDUSTRY INCLUDING BRUSH MAKING

List of Equipment Required

			Rs.	
A.	Fibre Extracting Machine and Fibre Carding Machine (by peddle)	1	100	For the extraction of fibres and carding of fibres.
B.	Batara Charkha	1	35	For spinning of Batara yarn.
C.	Batara Loom with all its accessories	1	50	For weaving of Batarats
D.	Adjustment Charkha with breaks and pulleys for high counts by power.	1	40	For spinning of fine yarn.
E.	Treadle charkha for high counts.	1	50	For spinning of fine yarn.
F.	Kumar loom complete with accessories and warping arrangements including drum etc. portable.	1 set	200	For weaving of matting and Navara Patti etc.
G.	Hessian Loom complete with accessories with warping arrangements including drum and bobbins, etc.	1 set	250	For weaving of Hessian matting of different designs.
H.	Rope making Charkha with trolly and Karmal with 4 hooks.	1 set	100	For twisting of Ropes
I.	Dyeing equipment and other minor equipments.		100	
J.	Doubling Charkha		50	Spinning of low count yarn for ropes.
K.	Machine assembling (study of the parts)			The Students should be taken to the work shops where there equipment are manu factured.

TRAINING IN FIBRE INDUSTRY

Sisal, Date Palm, Grasses	days
A. Extraction of Fibres, Carding of Fibres	13
B. Spinning of bataras Yarn (Sisal, Ambadi, date palm) ..	13
C. Weaving of bataras	13
D. Spinning of high counts powers	13
E. Spinning of high counts treadle	13
F. Weaving of hessian matings etc. and the warping: portable looms	13
G. Weaving of hessian mattings etc. and the warping: hessian loom	
H. Rope making and dyeing	13
I. Machine assembling: Study of the parts etc.	5 to 12
	116

There will be 8 batches of 3 candidates.

Whenever alternatives are pointed out the entire batch or any member of it has liberty of selecting the subject of his choice through out the period of Training or during any part of it.

NAME OF THE COURSE: *Ratton Industry (Naar industry)*

PERIOD OF TRAINING : *Four months.*

No. of working days	:	102
Holidays	:	16
Examination	:	2
Total		120

Topic (1)	No. of Days (2)	Practical (3)	No. of Days (4)	Theory (5)	Training for existing artisans (6)
1. Collection of Naar	25	Cutting of green peticles with 'Pathal'—Removal of dried stick—Removal of 'Agni Naar'—'Purani Naar' from green sticks—Removal of fleshy fibre—Sizing etc.	7	Drawing all of the diagrams of articles. Cost of production of articles of utility and fancy. Marketing with help of cooperatives.	Generally village artisans will know cot weaving for their own uses with ropes. In this case the entire process is to be taught to artisans who already know something in traditional process.
2. Knitting	30	Various kinds of knots—Dyeing the 'Naar' with basic dye-stuffs—Processing with improved tools—Weaving of a model cot and model chair.			
3. Basket	20	Making of Waste-Paper Basket—Cycle basket—flower basket—flask basket—Baby Teopoy—Baby cradles—Easy chair with foot rest.			
4. Cots	15	Weaving of folding cot—sitting cot. Easy-chair canvas etc.			
5. Utility of waste ..	4	Rope making with the fleshy portion collected—Manufacture of articles of utility with waste fibre.			

RATTON SECTION EQUIPMENT

1. Mattai sizing knife	5 Nos.
2. Naar sizing knife	8 Nos.
3. Purani sizing knife	8 Nos.
4. Cot weaving needle	8 Nos.
5. Hammer 2 lbs.	1 No.
6. Hammer $\frac{1}{2}$ lb.	1 No.
7. Hammer $\frac{1}{4}$ lb.	1 No.
8. Burner	1 No.
9. Stove	1 No.
10. Fork	2 Nos.
11. Folding scale	2 Nos.
12. Screw driver	2 Nos.
13. Hand Drilling	1 No.
14. Hand saw	2 Nos.
15. Hack saw	1 No.
16. Bucket 12"	2 Nos.
17. Dyeing Vessel 25 Lbs. capacity	4 Nos.

FIBRE INDUSTRY INCLUDING BRUSH MAKING

NAME OF THE COURSE : *Brush making*
PERIOD OF TRAINING : *Four months.*

No. of working days	:	102
Holidays	:	16
Examination	:	2
Total		120

Topic (1)	No. of Days (2)	Practical (3)	No. of Days (4)	Theory (5)	Training for existing artisans (6)
1. Collection of Fibre	10	Removal of Pathal from Palmyra trees—Extraction of black fibre from young trees—white from tappable trees.	5	Names of dye-stuffs—Machines capacity—Operation.	Being a new industry the question of traditional process does not arise.
2. Cleaning and sorting.	17	Cleaning of raw fibre—sorting—sizing.	5	Names and diagrams of tools with price.	
3. Wooden bases ..	3	Preparation of wooden basis for 25 varieties of brushes with fret work machine.	5	Drawings of all the 25 varieties of brushes.	
4. Drilling ..	10	Marketing of bases—Drilling holes 25 varieties of brushes with Drilling Machine.	7	Cost of production of all kinds of brushes, Marketing on Co-operative lines—Export of Palm Fibre to 36 foreign countries and other information.	
5. Pin making ..	5	Treatment to iron wire—Cutting—Bending and making of pins.			
6. Colouring ..	5	Colouring the fibre with basic dye-stuffs			
7. Fixing ..	15	Fixing fibre—Manufacture of Floor—Washing—Dusting—Scrubbing brushes—10 kinds.			
8. Brush making ..	13	Preparation of Horse-body brush, printing brush and other 13 varieties of brushes. Trimming with trimming machine.			
9. Finishing ..	2	Finishing—Polishing etc.			

BRUSH SECTION EQUIPMENT

1. Frat work machine (power)	1 No.
2. Drilling machine (power)	1 No.
3. Trimming machine (power)	1 No.
4. Fibre cutting machine	1 No.
5. Saw machine (power)	1 No.
6. Hammers (2 lbs. weight)	2 Nos.
7. Forks	24 Nos.
8. Hammers ($\frac{1}{2}$ lb. weight)	24 Nos.
9. Filling Nails (Punches)	50 Nos.
10. Chisel 4″	2 Nos.
11. Cutting knives	1 No.
12. Fibre cleaning comb	5 Nos.
13. Baser (30 Nos. set)	1 No.
14. Iron Anvil (28 lbs. weight)	1 No.
15. Horse shoe Magnet	2 Nos.
16. Dyeing vessel 4′ pan	2 Nos.
17. Lathe Machine	1 No.
18. Scissors	2 Nos.
19. Folding scale	2 Nos.
20. Hand Drilling (big size)	1 No.
21. Spanner set	1 No.
22. Wire cutter	2 Nos.
23. Iron piece	6 Nos.
24. Bucket	2 Nos.
25. Stove	1 No.
26. Working table for 10 artisans (8′ × 4′ × 2½′)	2 Nos.
27. Benches (8′ × 1′ × 2′)	4 Nos.
28. Stools	2 Nos.
28. Benchsaw 3′cutting capacity	1 No.

FIBRE INDUSTRIES INCLUDING BRUSH MAKING (PALM LEAF INDUSTRY)

NAME OF THE COURSE : *Palm Leaf Industry*
PERIOD OF TRAINING : *Four months.*

No. of working days	:	102
Holidays	:	16
Examination	:	2
Total		120

Topic (1)	No. of days (2)	Practical (3)	No. of days (4)	Theory (5)	Training for existing artisans (6)
		"A" DATE PALM LEAF			
1. Date palm leaves.	5	Collection of Date Palm leaves—Soaking Carding, with carding machine—Extraction of fibre—dyeing with basic dye-stuffs.	5	Cost of production of fibre articles—Marketing.	Artisans may know the art of making of leaf mats and baskets. But the Improved tools introduced here will increase the productive capacity. Further the improved designs devised here have great demand in the market. Hence the artisans following traditional method may be trained in all the topic mentioned for new artisans.
2. Thread weaving	5	Thread making with fibre with spinning charkhas.			
3. Articles of utility	10	Preparation of door mats with weaving loom—Ropes and hand bags etc.			
		"B" PALMYRA PALM LEAF			
1. Collection of leaves.	4	Collection of hard and soft leaves—Treatment—Sizing with improved sizing tool—Dyeing with different dyes.	10	Diagrams of all the tools—Cost of production of Palm leaf articles—Fancy bags and stalk articles—Demand for fancy articles in other countries—Export of leaf articles.	
2. Article of utility.	14	Preparation of sitting mats—Fans—Packing mats—Boxes—Toys—Eye hole knitting boxes—Vegetable baskets and lady's bags etc.			
3. Fancy articles	5	Diamond Thatties with various designs—Hats—Purses—Garlands—Flowers—Table vases etc.			

"C" FANCY BAGS

1. Fancy articles with utility.	14	Preparation of leaf mats with attractive designs—Preparation of boards with leaf mat and khadi cloth with rubber solution—Manufacture of Fancy leaf bags lined with leather—File covers—Money purses—marketing bags etc. Stitching of bags with sewing machine.

"D" STALKS

1 Removal of stalk.	5	Removal of stalk (Eark) from hard and soft leaves—fixing—Cutting—Dyeing.
2. Articles of utility.	15	Round Trays—Sieve—Onion baskets.
3 Fancy articles	10	Fancy Thatties weaving with ordinary looms. Flowers vases—with various designs.

LESSON NOTES ON PALM LEAF AND FIBRE WORK

Leaf consisting of green leaf portion, stalk and pathals—whole portion utilised—green leaf portion for making mats and baskets—inner stalk again and outer purani both useful as rope and for weaving cots—pathals for the extraction of black fibre.

(a) LEAF—tender and green leaf—tender useful for making fancy articles like bags, hats, purses, etc.—dyeing of tender leaves—required dust dissolved in water and heated at 100°C—few drops of acetic acid added—addition of acid helps the fixation of colour—in another—one vessel sufficient water with 10 drops of glycerine kept ready—first pass the leaves through the dye solution and see the dye thoroughly fixed—then keep them in glycerine solution for 15 minutes—glycerine gives shine—dry them in shade.

Green leaves partially dried—rib between two leaves separated—this rib is called Eark—separated leave parts—used in the work.

(b) EARK—two kinds—inner and outer—inner will be shorter and weak—outer will be long and strong—inner eark used for making onion baskets, winnows and also for stiffening purposes—outer eark after the surplus leaf part is removed, sized, bundled and exported to foreign countries like Canada and America—dollar earning one.

(c) STALK—the polished surface of the inner side is called Agani—very strong one, when the surplus fibres are removed, ratton like resemblance—used for weaving cots—the outer surface Purani—weak one—used for mostly tying purposes.

(d) PATHALS—two hand like portions in the bottom of a petiole, and hold the trees are called Pathals—Kurangumattai in Tamil—removed in wet condition—beaten with wooden hammers and the pith removed—black fibre available in the centre—further processed in a comb to remove the adhering piths—sorted and countries—fibre from pathals of young trees will be black—aged trees white—black fibres strong and fetch better price—white not so strong and fetch less price—used in brush making industry.

(e) TOOLS USED :—Leaf articles—sizing knife, sizing machine, scissor, vessels for dyeing, rule and scale—Black fibre extraction—cutting knife (Aruval) wooden beater and comb.

PALM LEAF AND FIBRE PRODUCTS EXERCISES

(a) How to dye palm tender leaves.

(b) Explain the nature and usefulness of different kinds of earks.

(c) In what way the stalk is utilised ? Explain.

(d) Narrate the process of extraction of black fibre and its use.

(e) List out the tools required in Palm leaf and fibre industry.

PALM PLANTATION EQUIPMENT

Date Palm

1.	Carding machine	2 Nos.
2.	Spinning charkha	2 Nos.
3.	Weaving loom	2 Nos.
4.	Wate tube 50l bs. cap.	2 Nos.
5.	Vessels for dyeing the fibre 25 lbs. cap.	4 Nos.
6.	Balance dial type	1 No.
7.	Cutting knife	2 Nos.

Palmyrah Palm

1.	Leaf cutting knife	6 Nos.
2.	Sizing (Leaf) knife	12 Nos.
3.	Leaf sizing tool	20 Nos.
4.	Folding size scale	4 Nos.
5.	Thatti Weaving loom	2 Nos.
6.	Flower Petal cutting dye	1 No.
7.	Stove	1 No.
8.	Vessals for Dyeing 15 lbs. Capacity	6 Nos.
9.	Small scissors	20 Nos.
10.	Sewing machine	1 No.
11.	Working table ($3' \times 2' \times 2\frac{1}{2}'$)	1 No.
12.	Marble slab to size leather	1 No.

PALM PLANTATION EQUIPMENT

1.	Crow bars 3′ length 1½″ dia.	20 Nos.
2.	Spades	20 Nos.
3.	Weed/Remover	20 Nos.
4.	Baskets	25 Nos.
5.	Roll Tape	2 Nos.
6.	Buckets 12″	24 Nos.
7.	Spray Pump	2 Nos.

GUR AND KHANDSARI MAKING

Preamble

The Gur and Khandsari Industry, the largest agricultural processing industry, provides continuous employment for 4 to 5 months in the rural areas to the cultivators, potters who prepare receptacles, and cartmen who transport its products from production centres to assembling markets and from there to exporting mandis. It accounts for 60 per cent of the sugarcane grown in the country. It supplies the bulk of the country's demand for sweetening agents estimated at 48 lakh tons. Its products have superior food value and sell comparatively cheap. Given appropriate policy and aid for its phased development through improved technique and introduction of improved implements, the industry can flourish to the great advantage of the villagers.

The industry affects the welfare of millions of people engaged in the production of sugarcane and gur. It strengthens the bullock economy, the mainstay of Indian agriculture, as it keeps them engaged for a longer period than any other single agricultural operation. Being essentially a decentralised industry, its expansion and development can be effected without disturbing the prevailing occupational balance in the sugar zones.

Rab, the raw material of Khandsari, is a twin of the Gur industry. It can be manufactured with a very slight change in the process with the same implements without any additional expenditure. Only a centrifugal is required to convert rab into Khandsari.

The Khandsari industry today is considered more as a second line of defence to the manufacture of gur, rather than as an independent industry with a specialised or exclusive market of its own. Its planned development as an integral part of the sugar industry with a definite share in the total output is, therefore, essential.

SYLLABUS

1. *DURATION OF COURSE* : 3 Months during the cane growing season

II. (a) **Object**

Even though the manufacture of Gur and Khandsari at the village level is being carried out from time immemorial, it was observed that this village industry was in a disorganised state. The fact remains that nearly 50 to 55 per cent of the total production of cane in the country is being dealt with by the village sector and only about 30 per cent to the factories. The recoveries of cane juice to cane and of sugar to cane juice in the village sector are considerably low due to wasteful method of manufacture and use of such equipment which is out-dated. The most important feature is that the Gur and Khandsari industry is an agricultural processing industry as the cultivator himself processes his cane. Organisation of the industry by introducing improved methods and technique, therefore, can ensure better returns to the grower himself, guaranteeing better living to the rural artisan and contributing a lot to the national wealth.

The implementation of the scheme calls for a well-built organisation of trained personnel having an intimate contact of the rural life and fairly good knowledge of various varieties of cane, suitable for manufacture of Gur and Khandsari, factors governing the efficiency of a crusher which constitute one of the most important equipment in the process of manufacture, techniques of designing an efficient furnace, the principles governing its efficiency, juice clarificants for refining of cane juice to obtain a better product and over-all modern technique of manufacture, scientific storage, gradation and marketing etc. For making such personnel available, it is necessary to conduct regular programme of training for average village artisan, keeping in view their general educational standards and ability to grasp what is demonstrated or explained to them.

(b) The syllabus for the trainees who are new to the subject need hardly be prescribed in the case of this industry. The reason is that the object of the industry programme is not to acquire more quantities of cane for processing at the village level. Even at present great quantities of cane are being processed at the village level by employing age-old methods which are wasteful. The object of the programme of development of the industry is to reorient the traditional processes on modern lines so as to ensure better returns and do away with the old wasteful methods. We have, therefore, to train up the existing craftsmen only. The syllabus enclosed herewith is provided for upgrading of the skill of the existing artisans.

The syllabus has been drawn up with due regard to the availability of electric power in the villages. In the course of practical demonstration however, the economics of processes, both by using electric power and manual power need be explained and provisions to that extent have been made.

Gradation of the product, its scientific storage and sales through cooperative organisations will ensure profitable marketing. The syllabus provides

for training in the technique of grading, the advantages accruing from a common production and marketing programme etc.

III. *Training course to be conducted by a mobile training unit or special* training unit.

IV. *Qualifications*

No qualification need be laid down. Mainly meant for the traditional artisans.

V. *No. of Trainees*

15. trainees per Instructor.

SYLLABUS

Topic	Practical	Theory
1. Cane Culture.	To carry out field operations wherever possible by visits to the neighbouring fields when the agricultural operations are in progress.	(*i*) Soil, climate and rainfall. (*ii*) Preparation of field, planting in trenches, selection of seeds, sowing time and seed requirements. (*iii*) Varieties suitable for Gur and Khandsari manufacture and yield per acre; their important characteristics. (*iv*) Manuring and irrigation. (*v*) (*a*) Cane diseases, (*b*) Cane pests } and how to control them. (*vi*) Composition of cane; maturity; under-ripe or over-ripe and treatment of fallen and lodged cane.
2. Gur and Khandsari technology.	Trainees to do actual crushing, construction of furnaces, boiling of cane juice, clarification, taking the charge to the final concentration, removing the pan and processing it for solidification in the moulds, grading and packing etc. Practices in assembling and dismantling the various equipment—Crushers and Centrifugals being important. Practices in the construction of multi-pan furnaces employed in the manufacture of Rab, Crystallisation and centrifuging etc.	1. Basic data of the industry. Area under cane in India; its percentage to the total crop area; utilization of the cane produced; annual yield (White sugar; jaggery and Khandsari in terms of money and quantity both); consumption per capita and its comparison with other countries. *Capital Investment*; No. of crushers bullock driven and power centrifugals; employment, effect of rural economy and bullock economy. 2. Existing conditions; specialities and drawbacks, wasteful methods; room for improvement in terms of money; reasons for continuation of the industry even after the advent of the mills. 3. Aim and object of the scheme; what the industry consists of (crushing, clarification, boiling stocking and marketing). 4. Main improvements—shape, size and functions of crushers. 5. (*a*) Evolution of crushers; capacity and extraction; parts and their function; names of standard improved crushers—their prices and procedure for obtaining them, minor repairs; supply of spares and need to replace traditional crushers by improved ones. 6. Evolution of furnaces, principles governing their construction, functions of and need for their various parts.

Topic	Practical	Theory
		7. Traditional furnaces v/s improved ones. 8. Dimensions and specifications of various improved furnaces (single pan, double pan and multipan). 9. Juice clarificants—their names and how to use them. 10. Boiling—striking points; difference in rab and gur. } vegetable 1 (*a*) chemical 1 (*b*) 11. Crystallisers; their utility, shape and how to use them. 12. Centrifuging. 13. Drying and breaking. (Cost of manufacture) 14. Gur manufacture. 15. Manufacture of cheap sweets, candy and mollases (gur) 16. Manufacture of sugar. 17. Stocking and packing. 18. Gur grading with packing—its advantages and how it should be undertaken.
3. Cooperation.	Visit to a few Gur and Khandsari Production and Marketing Cooperative Societies of the State and practically seen as to how they are working.	What is cooperation; its definition and principles. Organisation and working of Gur and Khandsari Cooperative Societies, broad principles their bye-laws, preliminary knowledge as to what records are maintained and what privileges cooperative societies enjoy.

SYLLABUS

A NOTE ON THE EFFICIENCY OF IMPROVED IMPLEMENTS

A crusher and a pan are the major implements used in the manufacture of Gur. In case of Khandsari, a centrifugal adds to the list. Besides, there are a number of other implements though minor but not the least important.

Crusher, a major implement role in the economy of the producer. It has been experienced that an indigenous crusher yields 10 per cent low recoveries of juice than the improved ones. With the average crushing capacity of a crusher per day at 30 mds. of cane, 3 mds. of juice or 12 seers of jaggery per day is left behind in the bagasse which is ultimately burnt. The loss when put in terms of money works out to Rs. 5 per day or Rs. 500 per crusher per season.

Similarly, an improved furnace apart from the better quality which it yields serves as a fuel saving device. It has been observed that a furnace without any proper design generally used by the producers consumes double (or even more) the quantity of fuel than the juice boil, whereas our improved furnaces are self-sufficient and no extra cost has to be incurred on fuel. To give an idea of the actual economy it is explained as below :—

	mds.
1. Cane crushed per day	30
2. Juice at 65%	19·5
3. Wet bagasse	10·5
4. Dry bagasse	6·0

To boil 19.5 mds. of juice (at 2 above) an inefficient furnace will consume 9.10 mds. of fuel out of which nearly 6 mds. only will be available, in the shape of dry bagasse. For additional 3 mds. of fuel the producer will incur nearly Rs. 5 per day which again is a loss which he never recovers. In a cane season of 100 days, on an average, waste resulting from an inefficient furnace works out to Rs. 500. The improved technique will, therefore, result in avoiding wastes and better yield in cane.

In addition to this, it has further been experienced that the quality of product by employing clarificants coupled with the use of an improved flat bottom pan and a furnace fetches at least additional Rs. 2 to Rs. 3 per md. to the producer than what he would get from his product of usual quality which the age-old methods obviously yield. The average production of a unit per season being 290—300 mds. of jaggery here again the net gain works out to Rs. 500 to Rs. 600 during the cane season for each unit (calculating @ Rs. 2 per md.).

LESSON NOTES ON GUR & KHANDSARI MAKING

Cane to be harvested only when it is fully ripe, Arrowing and flowering of cane marks the end of vegetative period of growth. After it has arrowed no further formation of sugar takes place in plant.

A simple and rough method to ascertain maturity is to test the Brix of Juice tapped from top half and bottom half of the cane by means of a hand refractometer. If the ratio between top and bottom brixes is between .95 to 1., the cane can be considered to have become mature-significance of brix to be explained.

Harvesting.—Cane to be cut at as low a point as possible as the bottom is richest in sugar. Tapping to be done just above the highest coloured joint.

After cutting, the cane begins to lose weight through evaporation and simultaneously a loss of sugar takes place due to inversion. The rate of loss of weight and sugar depend on the prevailing temperature and humidity. For this reason it is essential to crush the cane for gur manufacture as soon as possible after cutting. It should preferably be crushed within 24 hours of harvesting.

Manufacturing operations.—The main operations involved in the manufacture of gur are (i) extraction of juice from cane, (ii) purification of juice and (iii) concentration of juice.

Equipment used for the purpose consists of a crusher or a set of crushers for the extraction of juice and a pan or a set pans heated over a furnace or furnaces.

Evolution of the crusher.—From remote times crushing has generally been practised for the extraction of juice. The earlier method of crushing cane in India considered in bruising or grinding bits of cane in a mortar by means of a wooden pestle moved by bullocks. Mills used to be made by cutting down standing trees about 2 ft. above the ground level and utilising the 2 ft. stump as the mortar and cut out trunk as the pestle—Later on the stone mortars were utilised with wooden pestles—crude and inefficient method—still later it was followed by crushing cane between two wooden or iron rollers fitted close to one another vertically or horizontally. The two rollers mills were later substituted by 3 roller mills and these have become standard equipment—vertical mills are used with bullocks and horizontal ones are in vogue in the case of power driven equipment.

Bullock driven crushers—several makers of Bullock Driven crushers are available in the market. They are similar in essential details but vary in sizes and capacities. The extraction capacity of a Bullock Driven crushers varies from 2 to 4.5 mds. per hour. Juice extraction also varies from 50 to 70 per cent—Comparative data regarding Sultan, Kumar, Karamat, Hathee, Delhi, Madurai, Batala, Dhir, Kiran, Bar, Satara, Nasik, Bannerjee, Ashwiniqumar, Kamal, Cooper could be explained (price, No. and size of rollers, capacity per hour, extraction etc.).

Power crushers.—3 roller horizontal mills are generally in use though vertical 3 roller crushers driven by mechanical power are also used—

capacity varies from 15 to 55 mds. cane per hour according to size. Power requirements vary from 5 to 25 BHP.—comparative data regarding Sharat, Vasant, Hemant, Shishir, P.S.C., Massey, Sultan, Phoenix, Karamal, with power attachment could be explained with reference to the No. and size of roller, H.P. required extraction per hour, percentage of extraction and price.

Extraction—Quantity of juice extracted out from cane depends upon the quality of cane, design, features of the crusher and the feeding of the cane into the crusher and the pull applied—A fresh cane having lower percentage of fibre will give naturally more juice than a dried cane having a higher percentage of fibre. The design features such as roller settings and the type and size of groovings of rollers as also quality of roller material and rigidity of construction have a profound influence on extraction. From the manufacture point of view the cane should be of low fibre, soft and light coloured and rich in source content.

Furnaces—Heating should be a controlled process—Maximum heat energy from the fuel should be drawn for use—in the old furnace a pit was dug and pan kept over it. Fuel was not completely burnt. The opening served as feeding hole, ash outlet and air inlet. Improvements have been brought in now and separate feeding hole and grate air passage and flue passages have been made to ensure efficient combustion and economy in the use of fuel.

Single and multipan furnaces—The latter to handle large volumes of the juice. Preheating arrangement in order to utilise heat from waste gases—Salient features like size, capacity etc., regarding important furnaces like Meerut, Rhikh and Toofan, Bhilai, Poona, Sindewahi, Godavari, Pugalur to be explained.

Treatment of cane Juice—Composition—It is an opaque liquid varying in colour from grey to dark green according to the colour of cane from which it is expressed contains in solution all soluble constituents of cane, *viz.* sucrose, reducing sugar, organic acids etc. and besides air it carries in suspense on gums, fine bagasse fibres, wax, clay, colouring matter. Proportions of the above vary according to variety and age of cane, nature of soil manures applied and climate in which cane is grown. The proportion is approximately as follows :—

Water 70 to 72%, Fibre 12.5 to 17.5%, sugar 11 to 14%, Ash 0.5%, Nitrogenous substances like Albuminoids, Amino acids etc. 0.4% and fat and wax, Peotin (gum) and organic acids 0.6%.

Purification or clarification of juice—Suspended particles to be removed by straining and gummy constituents, fine particles of fibre by coagulation. As source is very liable to inversion and fermentation due to micro-organisms, it is necessary to boil the juice immediately after it is expressed from can whereby the albuminoids are also coagulated and development of micro-organisms is checked. Aim of clarification is to prevent non-sugar being formed again in the juice and next to remove as far as possible all objectionable matter which may be present. A further requirement is to prevent charring or over heating during the concentration of juice. The aim, therefore, is to make juice clear as well as to make it light in colour. The first object is achieved by coagulating the colloidal

impurities whereby the insoluble matter held in suspension by the colloidal constituents is also thrown down or rises to the surface leaving the juice clear.

Methods adopted for the *flocculation* of colloids are (i) addition of an electrolyte, (ii) action of electric current, (iii) change in the reaction of solution, (iv) elevation of temperature, (v) addition of vegetable albuminus which coagulate on heating and entangle suspended impurities and (vi) absorption by surface—attraction using flocculent materials.

In the process of manufacture of gur the fourth method alone or a combination of the fourth and fifth methods is generally employed. The procedure to be detailed :—

Clarificants—May be divided into two classes (i) vegetable clarificants and (ii) chemical clarificants. Principal clarificants are Deola, Bindi, Semal and Sukhlai. Freshly cut lower portions of Deola are utilised—the process of application to be explained. Bindi is also used in the same manner. In the case of Semal, green barks of the tree are taken and utilised in the manner of the above two. In the case of Sukhlai, however, dry barks of the plant are soaked in water and the liquid extracted is used for clarification.

Chemical clarificants, main ones are lime water, sodium carbonate, sodium bicarbonate, superphosphate and Alum. The details of the use of these clarificants are to be furnished.

Comparative efficiency of vegetable clarificants amongst themselves as well as between these and chemical clarificants to be explained.

Concentration of juice—Exact point at which the boiling is to be stopped and the pan struck is judged from the shape and size of bubbles found on the surface and from the sound produced from the bursting of the bubbles. Need for constant stirring at this stage, temperature of striking is about 115° to 117°C. Efficiency of boiling operation depends upon the maximum generation of heat in the furnace and the maximum utilisation of the heat for heating and evaporation of the juice and these factors are entirely influenced by the design features of the furnaces such as the design of the combustion chamber arrangement for fire grate, supply of air, baffle walls or arches, size of flue, size and height of chimney, number, size, shape, quality of construction and the relative position of the pans used.

While concentrating frothing occurs, this is to be prevented. Methods adopted to be explained.

Finishing—Either as lumps, laddoos or cubes, local methods must be compared with the practice prevalent in other areas of the country.

Manufacture of cream jaggery—In order to improve the colour of jaggery special treatment is given by utilising the principle of surface attraction—Details of the processes and the equipment to be utilised for the purpose to be explained (filtration process and settling process). The cost of manufacture of these articles must also be compared to the production cost of ordinary jaggery.

Manufacture of Khandsari—Importance of the correct striking point is to be emphasized. Use of crystallisers and centrifuge—their parts etc. to

be explained. Process of crystallisation to be explained. The salient points in the production of sugar by open pan systems and by vacuum pans to be explained in details—Recovery particulars to be furnished.

Disposal of molasses—Molasses from the open pan system contain a large percentage of sugar compared to that available from the vacuum pan system. It is edible and can be used as such. The molasses can also be converted into molassine gur by adding water or fresh cane juice and boiling to about 122°C when it reaches the gur stage. Its colour and keeping quality, however, will only be second rate compared to gur produced from fresh juice—The quality could, however, be enhanced by adding a small quality of khandsari when the temperature is about 110°. This ensures a crystalline structure to the gur, reduces considerably the stickiness of the product, helps rapid solidification of the gur and improves the keeping quality yield of molassine gur or cane is 4 to 5 per cent and on molasses about 59 to 64 per cent.

3. *Organisation*

Both gur and khandsari being edible products great care is to be exercised in their preparation. Unless hygienic methods are employed the use of the product may result in undesirable consequences instead of their being nutrients.

Very often individual ryots with small holdings are unable to bestow the attention necessary in the processing. For want of facilities and space etc. crude methods of production are still in vogue. All kinds of extraneous materials are allowed to be added to the pans in their anxiety to finish the work in a short time.

There is need to have control over the method of production and this will not be possible unless the production is undertaken on a collective basis and at stipulated places. The personnel employed also should be experienced people always with an eye on proper hygienic methods of production. This kind of organisation will also result in economy in the cost of production.

The organisation could preferably be on a cooperative basis and the societies organised could also undertake distribution of implements, fertilisers, insecticides and pesticides etc. Financing the cane growers will also be one of the functions of the societies. The personnel employed in such organisations can also advise the ryots in the selection of seeds, in suggesting the correct planting time and in allied matters.

4. Storage

Gur is like preserved fruit. We need gur for consumption throughout the year whereas it is produced only during a part of the year. We have thus to produce enough of it during the season and thereafter preserve it for consumption during the remaining portion of the year. If kept in the form of juice it would get fermented and become alcohol and other products by micro-organism—storing a liquid material will also present a serious problem.

In the solid form, however, the action of the micro-organisms is prevented though some loss of sugar is entailed in the process of conversion. This, of course, is inevitable.

Very often, the cultivators do not keep the entire produce with them and dispose of the surplus over their needs to the general public. The need for money to meet other items of expenditure also forces them to sell off their products immediately. Large stocks thus accumulate in the markets where they are stored for long periods extending over a year till they are consumed by the public.

Method of storage—As the quality of gur produced in the country varies from place to place, the problem of storage also presents numerous complications and no standard method of storage suitable for the entire country can be devised. Climatic conditions, local customs and resources very often decide the type of storage in particular areas.

The method prevalent in Uttar Pradesh, Bihar and Bengal, Assam, Punjab Bombay, Andhra and Madras could be explained and the relevant advantages and defects of the systems furnished.

The courses of deterioration of the gur whilst in storage should also be explained. Factors like the quality of cane juice, method of manufacture, atmospheric conditions of the place of storage and the form and shape of the product have an effect on this.

A review of the work done in India on the problem of storage of gur could be detailed.

5. *Marketing*

Marketing of the finished product is the most important aspect of the industry—unless this is organised on sound lines all the efforts taken to get a better outturn and incorporate improvements in the methods of production will not be of any avail.

Market study of the demand for the commodity and proper timely diversion of the product to the points of consumption is to be undertaken.

Grading of the product is also necessary in order to ensure a sustained market for the product—generally done by the merchants by a visual examination of the texture and testing the flavour by eating a small piece. Hardness is tested by pressing in the thumb nail or by making a scratch on the surface with a pen knife or some other instruments.

The factors forming the basis for grading the gur have to be explained—the significance of these factors in relation to quality is also to be detailed.

Cooperative societies could be organised for wholesale and retail sale. Such societies could also undertake grading—lessons on cooperation—principles—benefits—organization of cooperatives—books of accounts and registers to be maintained.

PALM GUR MAKING

1. *Syllabus*

The syllabus, for training in this craft is divided into two categories as below :—

(a) Tappers proficiency course.

(b) Artisans course in palm gur and palm gur products making.

2. *Duration*

(a) 4 months.

(b) 4 months.

3. *Qualification*

No educational qualification is necessary.

4. *Age limit*

Same as prescribed by the Committee.

5. *Training centre location*

The training may be given by mobile training parties in suitable places in C.D. Blocks. 15 trainees to be selected for each course.

6. *The object* :

The object of training is to give training in improved process of tapping and in the manufacture of palm gur and in the improved processes of making palm gur and other palm gur products with the latest tools and implements devised under the auspices of the Khadi & Village Industries Commission. Total number of tapable palms in India mostly date and palmyra is estimated to be over five crores. The significance of the training also lies in providing seasonal employment to the villagers on a large scale.

TAPPER PROFICIENCY COURSE

PERIOD OF TRAINING—*Four months*

Topic	No. of days	Practical	No. of days	Theory	Training for existing artisans
1. Preliminary Operation ..	20	Survey & Selection of palms required for tapping—observation of tapping system of spathes.	15	Selection of trees—Maintenance of tapping tools—Methods of using lime as preservative.	Exercises in all the topics.
2. Climbing	30	Traditional process—Aerial rope ways—climbing of date palms with bamboos.			
3. Tapping	30	Preliminary operation and actual tapping.			
4. Collection of Neera ..	10	Liming of pots—Pretreatment to Neera collection pots such as lacquering, waxing etc., Hygienic treatment—washing and drying of Neera collecting pots.		The best ways of tapping—with rest to the trees—advantages filtration of juice and use of improved furnace—economy in the use of fuel etc.	
5. Processing	8	Filtration of juice—Clarification with triple superphosphate or phospheric Acid —Finding of Neera test papers Clarification with CO_2—Feeding of furnace, Striking point—Moulding—Packing—Storage.			
6. Construction of furnace ..		Construction of 'K' fayat, Muffed & Sakakari, Furnace.			

TAPPERS PROFICIENCY COURSE

Equipments for 20 Tappers

Date Palm Tapping

1. Climbing Rope (Patta) with hook	15 Nos.
2. Axes @ 2 per tapper	30 Nos.
3. Tapping knife — 2 per tapper	30 Nos.
4. Kit box made out of bamboo mat	15 Nos.
5. Uniform (Half Pant and Shirt)	15 Nos.
6. Knife Sharpening stone @ 1 No. per 5 tapper	4 Nos.
7. Bamboo to connect the trees—20′ length 100 Nos. per tapper	15 Nos.
8. Small coir rope to tie the bamboos to the tree	20 lbs.

TAPPERS PROFICIENCY COURSE

Equipments for 20 Tappers

Palmyra Palm Tapping

1 Kit Box	15 Nos.
2. Cutting knife	15 Nos.
3. Slicing knife	15 Nos.
4. *Massaging horns for*	
(*a*) Male "Spathe"	15 Nos.
(*b*) Female "Spathe"	15 Nos.
5. Lime powder box	15 Nos.
6. Chest Protector (Leather) 7″ × 7″	15 Pairs.
7. Ankle Protector	15 Nos.
8. Neera collecting can—30 lbs. capacity—made out of tin	15 Nos.
9. Coir rope 1¼″ (Dia)	
10. Uniform (Half Pant and Shirt)	15 sets
11. Small coir rope to tie the big rope with tins	20 lbs.
12. Fibre hoop	15 Nos.

PALM GUR SUGAR MAKING

NAME OF THE COURSE *Sugar making with Vacuum Pan*

PERIOD *Four months*

No. of working days	:	102
Holidays	:	16
Examination	:	2
TOTAL		120

Topic	No. of days	Practical	No. of days	Theory
1. Construction of Furnace ..	8	Construction of deliming Furnace for evaporator.	3	Plan of the furnace—working of the evaporator—Control of pressure—Maintenance of the equipments
2. Deliming	8	Deliming with CO2—Working. of pan—Controlling of P. H filtration.	2	Deliming process—Crystallisation—growth of crystals etc.
2 Processing & controlling with syrup	30	Filling up the evaporator with neera—Feeding the evaporator with coal or any fuel available Vacuum and heat—Stroming of syrup of 60 to 70 Bx.	2	Kind of fuel to be used—Economics of fuel consumption.
4. Crystallisation	30	Filling the pan with syrup—Concentration and seeding—Growing of crystals in 4 hours in Vacuum Pan.	2	Cost of production of sugar with Vacuum pan—Comparative study with open pan.
5. Crystallisers	2	Transfer of Massacute to crystal-—isers—Keeping 12 hours.	2	Organisation of sugar producing—Units by cooperative.
6. Sugar making	5	Purging with Centrifugal machine—Drying, Grading and Packing.	2	Marketing.
7. Second crop	2	Concentration and crystallisation purging during and packing.	2	
8. Utility of by-products ..	5	By-products manufacture with Molasses such as Neera prash, golder syrup etc.		

SUGAR MAKING WITH VACUUM PAN

Equipments for 20 Trainees

1.	Deliming Vessel with accessories	1 Set.
2.	Vacuum evaporator set	1 No.
3.	Crystallisers 500 lbs. capacity	3 Nos.
4.	Centrifuga Machine power driven	1 No.
5.	Buckets 12"	1 dozen
6.	Containers 50 lbs. capacity	1 dozen
7.	Drums to keep Molasses 150 lbs. capacity	1 dozen
8.	Sugar drying Plant from $5' \times 3' \times 2\frac{1}{2}'$	2 Nos.

PALM GUR CANDY MAKING

NAME OF THE COURSE : *Candy making*

PERIOD OF TRAINING : *4months*

No. of working days	..	100
Holidays	..	18
Examination	..	2
TOTAL	..	120

Topic 1	No. of days 2	Practical 3	No. of days 4	Theory 5	Training for existing Artisans' 6
1. Traditional process ..	15	Selection of Neera—Concentration—striking point—Crystallisation with earthen crystallisers 40 days—observation of striking Temperature with traditional process.	5	Historical background—Fabrication of Metallic Crystallisers and frames insulation with various materials like dry sandash or paddy husk.	Practical:— All the topics except item No. 1.
2. Improved method processing.	30	Clarification and filtration of Neera for candy making—with superphosphate or Phosphoric Acid—Concentration with improved pans (Salamath furnace) Concentration with shallow pans—feeding of furnace —Precautions in the preparation of candy rab—Testing the rab with thermometers. Insulation to metallic improved crystallisers.	5	Advantages of improved process over traditional process—Cost of production of candy by traditional and improved process. Comparative study—the extra income to the tappers.	
3. Collection of Candy ..	10	Insertion of zinc wire frames—(Korandy) etc. Removal of mother liquid from crystallisers—Candy crystals—Removal of candy crystal from crystallisers with teethed spoon. Drying of Candy—Grading—Packing—Storage.	10	Medicinal use of Palm Candy—Marketing of Palm Candy through cooperatives.	
4. Preparation of Candy	5	Insertion to the Candy crystallisers instead of Ordinary Korandy & frames—Harvesting of candy within 25 to 30 days.			
5. Second crop—Candy ..	5	Concentration of Mother liquid available from first harvest—Crystallisers—Harvest of 2nd crop of candy.			

6.	Brown sugar making ..	5	Concentration of Mother liquid obtained in the first harvest—Concentration to sugar Rab Stage—Preparation of brown sugar with Centrifugal Machine.
7.	Utility of Molasses ..	3	Instead of harvesting second crop of candy.
			Introduction of last molasses as sweetening agent in Tea & Coffee—preparation of last grade gur.
8.	Storage ..	2	Stocking in gunny bags (traditional)—Packing in tins etc.
9.	By-products ..	4	Preparation of by-products.
10.	Field work ..	3	Attending to the production centres of other artisans engaged in candy manufacture.

CANDY MAKING EQUIPMENTS

1.	Salamath Pans and other accessories	2 Sets.
2.	Buckets 12″	6 Nos.
3.	'H' shaped metallic crystallisers (20G) 50 lbs. capacity	35 Nos.
4.	Candy strainer 2′×4′	2 Nos.
5.	Toothed spoon	4 Nos.
6.	Centigrade thermometer 0—250°C	2 Nos.
7.	Hitree sprayer to wash candy	1 No.
8.	Centrifugal machine pedal driven	1 No.
9.	Candy drying wooden platform (5′ × 3′ × 2′)	1
10.	Shed for crystallisers 30′ × 15′	1
11.	Insulating materials—paddy husk or saw dust	20 Bags.
12.	Enamel Mugs—4 lb. capacity	2 Nos.

LESSON NOTES ON PALM PRODUCTS INDUSTRY

II SYLLABUS

1. Palm Juice.
2. Palm Jaggery.
3. Palm Sugar.
4. Palm Candy, confectionery etc.

III LESSON

(a) *Palm Trees*—4 varieties of sugar yielding palms in India—Palmyrah, Coconut, Date (wild) and Sago—Neera the nectar of these palms—Spathes of palmyrah, coconut and sago to be tapped for neera—top portion of the trunk just below the crown to be tapped for Date trees.

(b) *Palmyrah*—male and female trees—male trees put forth spathes first—finger like and flower bearing—duration of juice yielding period 1 to 1½ months—daily quantity per tree 2 to 4 lbs—less gur contents in the juice i.e. 10 to 12½% jaggery over the juice—gur also poor in keeping quality.

Female trees—fruit bearing spathes—duration 3 to 4½ months—daily quantity per tree 4 lbs. to 8 lbs.—gur yielding 12½ to 16% over the juice season of tapping November to August—average capacity of a tapper 25 trees.

(c) Coconut puts forth one spathe every month—possibility of tapping throughout year—no size among the trees but in flowers—tapper's capacity 20 to 30 trees per head—jaggery yield 16% over the juice.

(d) *SAGO*—Spathes full of strings and they have to be tapped—season through out year—a tapper can tap 5 trees per day—a tree will yield juice for 4 months—the quantity per tree will be 10 to 20 M.M.—jaggery yield 10 to 12½% over the juice—mostly available in mountainous area.

(e) *Date*—top portion of the trunk just below the crown is sliced—the place to be selected facing the sun—this helps the easy and quick drying of the tapped area before the next tapping the tree also should be given rest for two days between tappings—a tappers' capacity 25 trees in a day—due to rest system 3 batches atleast necessary for each tapper—juice yield per tree per day 6 to 10 lbs.—jaggery yield 10% over the juice.

(f) *Neera*—the sweet sap oozed out from the tapped portion is called Neera—collected in a lime coated pot—otherwise gets fermented by the action of bacteria and enzymes in the airlime solution preserves the—neera for 6 hours after its drawal.

Highly nutritive—possesses minerals and salts sufficient to build up a healthy body—consumed as a cold beverage in summer days—also used for preparing jaggery, sugar candy, confectionery etc. Palm Product industry provides employment to village artisans and also turns waste into wealth.

(2) *Palm Jaggery*

(a) *Process of Conversion*—Deliming—the lime treated Neera heated up to 60°C. and added with superphosphate solution—boiled up to 100C°—all lime precipitated and settled down—filtered through a filter bag made out of white drill cloth—the filth and the lime precipitates removed—only the clear juice taken for further boiling—otherwise the lime and other undissolved matters get easily charred and blacken the whole finished product.

The clear juice boiled and concentrated upto 118°C—transferred to moulds of required size—fire to be carefully controlled at the final stage—otherwise the products will get charred.

(b) *Furnaces and pans*—different kinds of furnaces—crude furnace with mud pots as boiling vessels, safety or salamath furnace with round bottomed shallow metallic pan, economic or kifayath furnace with rectangular pan and Sakkari or cooperative furnace with one big and two small rectangular pans.

Crude Furnace—Round wall and three to five round openings to hold boiling pots—a feeding hole and smoke out-let in the opposite directions—smoke trouble and side heating—longer time for boilings and larger fuel consumption 3 to 4 hours to boil 100 lbs. of juice and 100 lbs. fuel for the same—the finished gur black in colour and full of dirts and filths—charred taste.

Salamath or safety furnace—round shaped fire chamber—fire grating at 18″ depth—ash pit below it—mouth of air vent adjusted just below the fire grating—a smoke channel and then a chimney fuel fed through a hole into the chamber and fresh air supplied through air vent below the fire grating. The smoke escapes through the smoke channel and the chimney—through combustion due to uninterrupted supply of fresh air—Thus short time for boiling and less fuel consumption—only 2 to 2½ hours for boiling 100 lbs. of juice and 54 lbs. fuel for the same—no smoke trouble-charring avoided because of no side heat and fair colour obtained.

Specification for a Salamath or safety furnace to suit 3′ diameter pan—capacity 250 lbs. in a charge—Fire chamber 33″ diameter and 24″ depth—Fire grating to be placed—ash pit of 16″ square and 24″ depth—a tub of 4″ diameter to be constructed in a side of the fire chamber as airvent—the bottom mouth to be just below the fire grating—smoke channel in the back side—6″ long, 7″ height and 4″ breadth—4″ below the top and 11″ above the grating—Smoke channel in the back side—6″ long, 7″ height and wide—4″ below the top of the chamber and 12″ above the grating—top of the channel to be covered with bricks and sand—chimney to be constructed at the end—8′ height and 12″ square—if round metal to be fitted, the same height and 9″ diameter—the centre points of the chimney, smoke channel, fire chamber and the feeding hole to be in straight line then only the function and draught will be proper.

Specification for a round pan—Bottom diameter 3′, mouth 3½′—9″ height in the centre—12 to 14 gauge M.S. Black Sheet for the bottom and 16 to 18 gauge M.S. Sheet for the sides—mouth to be bent outwards and ¼″ rod to be inserted—4 rings of ⅜″ rod—two in each side—joints to be riveted.

Fire grating—18″ long and 14″ breadth—½″ M. S. Rod to be put lengthwise leaving ½″ space between two rods—rods to be joined over side plates of 1″ breadth and ¼″ thickness.

Economic or Kifayath Furnace—Rectangular mouth to hold a rectangular pan—round fire chamber in the front side—a slanting flue till the chimney—fire grating—ash pit—air vent and bottom mouth of it just below the fire grating—chimney—hot air escaping along with the smoke is utilised—as the neera will be moving always, no chance of remaining over in the direct heat—thus charring avoided to larger extent—still less fuel consumption—no vast area required for the construction—construction can be completed with less labour and without bricks—only 30 to 35 lbs. of fuel for boiling 100 lbs. of juice—mostly suitable in areas where sugar production undertaken on large scale.

Specification for a Kifayath furnace to suit 6′ pan—Length 5′-9″ Breadth 1′—10″—fire chamber 18″ diameter and 18″ depth—Ash pit 24″ depth and 12″ square—Air vent of 4″ diameter tube in one side—feeding hole in the front side 6″ height and 5″ breadth—4″ below the top level and 8″ above the grating—connecting channel in the back side 9″ long, 7″ high and 5″ broad—chimney 8′ height, 12″ square in the bottom and 6″ in the top—baffle wall arrangements to be put in the connecting channel in the back side 9″ long, 7″ high and 5″ broad—chimney 8′ height, 12″ square in the bottom and 6″ in the top—baffie wall arrangements to be put in the connecting channel—Slanting flue to start 5″ above the grating and only 4″ below the top at the connecting channel—this can be constructed both above and below the ground level.

Specification for a rectangular pan—150 lbs. capacity in a charge—6′ long, 2′ broad and 6″ height both at the bottom and the mouth—mouth to be bent outward and a rod. ¼″ thickness to be inserted—4 rings of ¼″ rod two in each length-wise side—18″ to 22 gauge—G. I. Sheet to be used for both the bottom and the sides.

Fire grating—16″ length, 12″ breadth—½″ thick rod to be fixed with 1″ wide and ¼″ thick plates leaving ½″ space between two rods.

Sakkari or Cooperative Furnace—Capacity in a charge 1000 lbs. 500 lbs. in the front pan—250 in each of the two pans placed in the back side—to facilitate the boiling of large quantity of juice fuel consumption 30 to 35 per cent over the raw juice taken for boiling.

Specification to be got from a technician of palm gur section of Khadi Commission working in the nearest palm gur centres.

(3) *Palm Sugar*

Up to deliming reboiling of the clear juice the process is same as in jaggery production—110°C transfer the rab into the crystalliser and allow it to cool slowly—by stirring till the crystals are formed thickly, keep it for overnight, and in the next day morning separate the sugar crystals from the molasses with the help of a pedal driven centrifugal machine—collect the sugar, dry in the open sun and pack in alkathaine packets, for marketing.

Molasses is also to be collected while centrifuging and converted into jaggery by boiling as in jaggery production—quality of jaggery somewhat interior.

Rab yield will be 16 to 20% over the juice—Sugar yield 6 to 8% over the juice and 30 to 40% over the rab—second grade jaggery 6 to 8% over the juice and 30 to 40% over the rab.

Crystallisation—Slowly bringing down the temperature helps the formation and development of crystals—Crystallisers facilitate these purposes—Bucket crystalliser is one among the several types of crystallisers—but principles are the same.

Two buckets—one big and another small to be taken—fill up the big with warm water and small one with the rab just transferred from the pan—place the small bucket in the warm water bucket and stir with a blunt edged wooden rod for at least 4 hours—allow it to be in the same condition over night.

Specification of Crystalliser set—(1) Big Bucket 14″ at the mouth, (2) Small Bucket 12″ at the mouth (3) 18″ long and 4″ broad wooden cricket bat like stirrer with a handle.

Necessary machinery and other accessories required—pedal driven centrifugal machine, water syringe monkey spanner, moon from wooden scraper—sugar drying trays of 4′ long and 2′ broad and 6″ high, made out of 22 gauge G.I. Sheets—G.I. Sheet drums for keeping molasses and buckets.

N. B.—Blue prints of Pedal Driven Centrifugal Machine may be obtained from Palm Gur Section of the Khadi and Village Industries Commission, Dahanu, Thana District, Bombay State.

4. *Palm Candy, Confectionery etc.*

(a) *Palm Candy*—Old and new method of preparing Palm Candy.

(b) *Old Method*—Boiling of lime treated Neera—concentration upto 105 to 108°C—then the rab to be transferred into earthen pots—twigs of Korandi herb to be inserted into it—they serve as bases for the candy—pots burried neck deep in sand—duration 2 to 4 months—then the candy formed in the sides of the pots and the Korandi twigs collected, washed and sun dried. Disadvantage—breakage of pots while collecting the candy—irregular and ununiform crystals—dark brown colour—poor yield—2 to 3% over the juice—longer period.

(c) *New Method*—Deliming and decanting—all foreign matters and undissolved lime particles are carefully cleared—otherwise candy nucleus will catch them and developed-taste will be spoiled by these particles remaining inside of the candy—only decanted clear juice is taken for boiling—concentrated upto 108°C—striking point determined by the use of thermometer—the rab transferred into 'U' shaped metallic vessels—steel wire frames with hangers attached with twigs of Korandi herb inserted—burried in sand—candy crystals developed—holding the sides of the vessel and the twigs of the herb—the 'U' shape helps the easy movement of the nucleus and formation of more crystals—duration 1 to 1½ months—candy collected by scraping the sides without any breakage and removing the frames easily—washed and sun dried—because of the high purity of juice

after deliming and decanting the colour of the candy prepared in the new method is very attractive—as the metallic vessel retaining heat and allows only slow cooling, the yield is also high, 5% over the juice.

Specification of a 'U' shaped metallic vessel—Length 18″, Breadth 12″, Depth 14″–18 to 20 gauge G.I. sheet to be used—shape of 'U' in the sides—a lid also necessary.

Frame—Centre steel wire ¼″ thick and 18½″ long—three to five hangers—same steel wire bent of ⅛″ thick with a hook in the centre to hang—four wire pieces to be tied horizontally with the hanger in a conical form—length of the first piece 10″, second 7″, third 4″ and fourth 2″—in between the space the twigs to be tied.

N. B.—The washed out molasses in both the old and new methods not wasted—molasses of old method converted into second grade jaggery—molasses of new method utilised for making cheap brown crystal sugar.

Confectionery—Sweets prepared out of gur or sugar by inverting it with the addition of glucose or citric acid and flavouring it with essences—gur for the manufacture of toffees and chocolates—sugar for the drops, slices and lozenges—Toffees and chocolates to be finished in lesser temperature but the drops and lozenges at higher one.

(a) *Toffee*—Take 4 lbs. Palm Gur or Palm sugar—dissolve with water and filter—then boil—add 1 lb. glucose and continue the boiling—at syrup stage add 5 lbs. milk and allow it to boil then add 3 tola Vannillin powder, ¾ lb. starch and 4 ozs. of butter—mix it well by rubbing thoroughly while boiling—at 255°F remove the vessel from the oven and pour the contents over a marble stone plate already brushed with coconut oil—Mix 1 drm. of Bush Toffee Flavour—make it into a square with uniform thickness and cut into small pieces with help of toffee cutter—when cold, wrap in waxed paper and pack—total products will be 6 lbs.

(b) *Chocolate*—Mixing coco powder with the same ingredients at the time of adding butter—every other process same as in toffee.

(c) *Implements*—Tin coated copper boiling vessel—stove, strainer, iron stirrer, marble stone plate or broad wooden mould—wooden roller—rolling cutter—scissor.

(d) *Drops*—Dissolve 4 lbs. of sugar in 1 lb. of water—filter and heat —add 1 lb. of glucose and dissolve it well—concentrate upto 300°F.—transfer the mass over an iron plate—add ¼ oz. tartaric or citric acid 2 drms. of flavouring essence and 1 drm. of dye—mix it thoroughly and allow it to get cool for some time—then cut it into slices—grind the slices in the hand driven drop machine—put French chalk powder over the rollers and the drops while grinding to avoid sticking—take the drops in a separate tray, rub well and pack—the products will be 4 lbs. 4 ozs.

(e) *Machine and other accessories*—7″ size drop machine stand—4 roller sets of different design and size—Hot plate 3′ long, 2′ broad and ¼″ thick M. S. Sheet, in three sides leaving one breadth side walls of 1″ high—¼″ thick M. S. plate to be welded—cold plate—platform to be constructed with bricks and cement plastering 6′ long, 2¼′ broad and 2¼′

high—in three sides of the surface leaving one breadth side facing the machine stand, walls of 1½′ high and 1′ broad to be constructed—the surface and the side walls nicely polished with cement—stove, tin coated copper boiling vessel, aluminium deksha for mixing, cloth strainer, moon shaped copper scraper, scissor, a table knife, stainless steel small spoons.

N.B.—(1) Boiling in aluminium vessels other than tin coated copper one spoils the taste—(2) hot plate helps to retain the temperature of mass till all the slices are ground—otherwise it will get cold easily and become solid in no time—(3) by the addition of glucose with sugar crystal formation is arrested—tartaric and citric acid also will serve the purpose—but poor keeping quality in the product as it has to be prepared at low temperature.

Exercises

LESSON 1—PALM JUICE

(a) Describe the four varieties of sugar yielding palms in India.

(b) In what ways Palm Juice is useful to human being.

(c) Give percentage of gur yield and the duration of tapping season of each palm.

LESSON 2—PALM—JAGGERY

(a) Give in detail the process of improved gur manufacture.

(b) What are the different kinds of furnaces used in Palm Gur industry.

(c) Give specifications for two important kinds of pans and fire gratings which are used in Palm Gur Industry.

LESSON 3—PALM SUGAR

(a) Narrate the processes involved in Palm Sugar production out of Palm Juice.

(b) List out the important machineries and other accessories required for the manufacture of dried sugar from raw-rab.

LESSON 4—PALM CANDY AND CONFECTIONERY

(a) Explain the old and new method of Palm Candy Production out of Palm Juice with fact and figures.

(b) Differentiate toffee and chocolate and give a formula for the production of 6 lbs. of chocolate.

(c) What is meant by confectionery and explain the process of drop manufacture ?

(d) What are the important machineries and implements required for drop production ?

SOAP MAKING FROM NON-EDIBLE OILS

Preamble

Nature has been bountiful in India and many varieties of non-edible oil-seeds bearing trees abound in almost all parts of our country. The seeds of these trees go waste as no systematic attempt is being made to collect and utilise them for the human benefit. In the past the oils of these seeds had their own specific use in the preparation of medicines and for wick lamps in the homes.

The important seeds are : Neem, Karanj, Undi, Khakhan or Peeloo, Pisa, Nahor, Gaderdi, Tarwata, Kamala, Chalmogra and many more such as Baruni, Jagni, Tobacco, Awakgege, Bobbi, etc. They grow on trees which are found abundantly in villages, plains, forests, on river banks and waste lands. In some areas of our country some of these trees are exclusively found, depending upon the soil and climatic conditions. Some of these seeds can replace coconut oil and groundnut oil in soap making. Mention should particularly be made of Khakhan seeds found in Gujarat and Rajasthan areas, whose oil has almost the same characteristics as the coco-nut oil and can well replace it for industrial uses. Other varieties in the Khakhan oil group are "PISA" (In Bombay and Orissa States), "CAMPHOR FAT" (found in Dehra Dun and Saharanpur forests and Nilgiris in Madras), "RAM JAVTRI", "JAIPHAL", etc., Undi & Bobbi oils are available in coastal areas and can replace groundnut oil in soap making.

SYLLABUS

Duration of course : 3 months to suit seed collection season

(a) *Objective*

The Non-edible oils and soap industry scheme was launched by the Khadi & Village Industries Commission with a view to tapping the large quantities of non-edible oilseeds of different varieties available in the country. These seeds were hitherto exploited due to their scattered growth, processing difficulties, difficulties in utilisation of the oils which usually are accompanied by deep colour and foul smell, and above all lack of correct information regarding their distribution and up-to-date knowledge of their various properties. The collection of non-edible oil-seeds, processing, oil pressing and their utilisation offer a new avenue for providing part-time, full-time, and seasonal employment to large numbers. Certain non-edible oils which have special medicinal properties and other having a ready commercial demand everywhere can serve as earners of valuable foreign exchange.

The implementation of the schemes calls for a well-built up organisation of trained men having an intimate contact of the rural life and a fairly good knowledge of the distribution of different varieties of non-edible oil seeds, methods of collecting, processing and storing them, oil pressing and utilisation of these oils for appropriate and useful purposes. With these objectives in view, the personnel for taking up the work will have to be selected and trained.

(b) (i) The Syllabus for trainees who are new to the subject is enclosed herewith. The traditional artisans can take the training for a shorter period than what has been presented according to their standard of attainment.

(c) The contents of programme of the syllabus have been given. But it is not possible to detail methods of teaching as it is essentially practical training. Trained Instructors from the Commission are available.

(d) Emphasis on practical side has been adequately given in the syllabus and in the way as desired.

NON-EDIBLE OILS INDUSTRY

(Duration of Course : 3 months to suit seed collection season)

Topic	Practical	Theory
1. Study of non-edible oil seeds, plants, their description, use of their different parts, Preservation and Plantation.	Inspection of trees, wherever not available, models and posters to be shown.	(*i*) Study of different non-edible oil seeds bearing plants: Neem, Mohwa, karanja, undi Pilu (Khakhan), Pisa. (*ii*) Climatic conditions conducive for proper growth time taken to flowering, bearing season, use of various parts of the plants, leaves, bark timber, fruits and seeds. (*iii*) Plantation and preservation with approx. annual income with mature, in case of Mohwa, Pile and Pisa. (*iv*) Yields of seeds per tree.
2. Seed collection : (*a*) Survey of potentialities.	To estimate the number of different non-edible oilseed trees in a given area. Drawing a map of the area and marking there in the approach roads (Kacha and Pacca) rivers, rail lines, population of trees, situation of godowns for storage, Gram panchayats, village level workers, probable persons or agencies helpful for the work.	(*i*) How to conduct the survey of the area to assess the number of trees. (*ii*) How to select seed collection centres and sub-centres. (*iii*) Selection of keymen to act as agents or assistants in the work and giving them guidance in efficient methods of seed collection.
(*b*) Organisations for collection.	Visits to seed collection places and actually collecting seeds.	(*iv*) Types of Organisation for seed collection. (*a*) By appointing agents and sub-agents. (*b*) Through contractors. (*c*) By starting sub-centres. (*v*) Negotiations with the Government, Panchayats or Private owners, if necessary to acquire collection rights. (*vi*) Nature of propaganda, publicity to be carried on to propagate the idea of collecting non-edible oilseeds.
(*c*) Economics	To draw proformas for the maintenance of different registers, purchase registers.	(*vii*) Method of fixing price of seeds per unit of weight or measure.

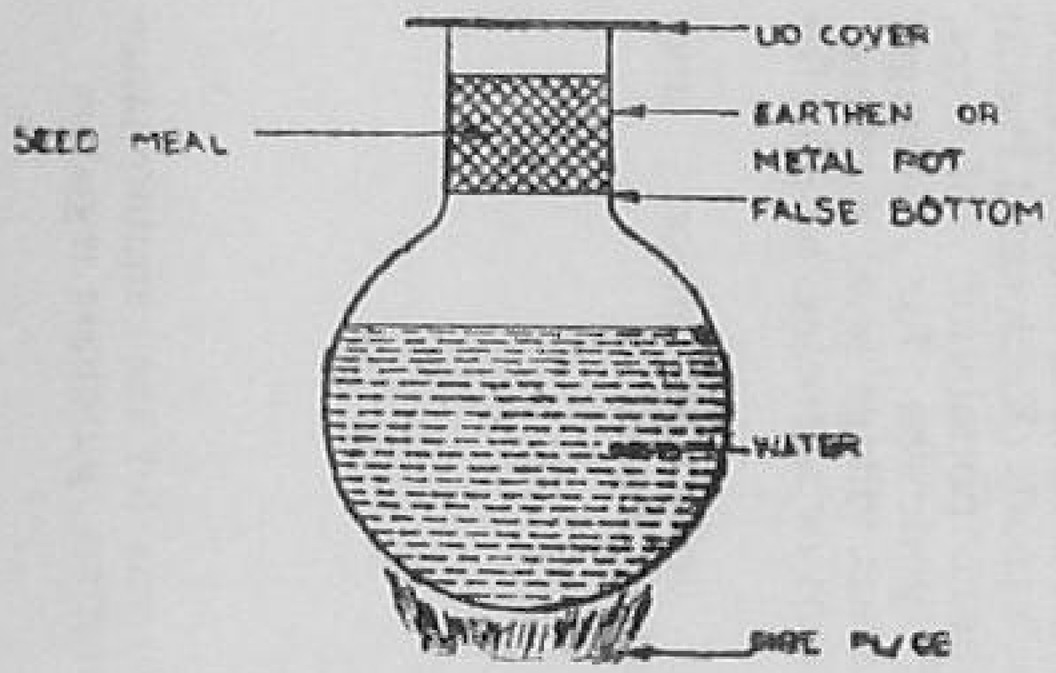
LESSON NOTE ON CHAPPA OR CHIPPA

Chappa is a very simple device for pressing oil seeds. The device is still in use in tribal areas and much popular for pressing Mahua seeds. The Chappa can be seen in villages in forest areas of Bihar, Orissa, West Bengal, Assam, Madhya Pradesh in some form or the other.

Description.—Chappa is made of a big log of wood 8′ to 10′ in length with a diameter of 1′ to 1½. The log is cut two parts along with length. The log is fitted horizontally. The lower part is stationary while upper part moves up and down on one side. On the middle of the lower part a circular grove for the extracted oil to flow is made. (Fig).

Process.—(*i*) The seeds to be crushed are milled to fine uniform powder. This is generally done by denkies used for hand pounding of rice and cereals.

(*ii*) The powdered seeds are then cooked in a pot or a basket. The bottom of the pot or the basket is kept false and are kept on water bath which is heated directly. (As shown in fig).



The cooked meal is then wrapped in jute cloth or filter cloth and tied with coir string thoroughly. The packet thus wrapped is kept on the grooved centre of the bottom half of the Chappa. The upper half is released and allowed to press the seed meal packet. Then rope loop which is tied to the fixed pole fixing the lower half of the Chappa log is taken to the other part so as to cover the upper log fully. The log is then pressed downward by a wooden bar by simple lever arrangement the pressing should be gradual. This pressing helps oil to come out of the meal slowly. The flow increases and becomes steady as the pressure goes on increasing. When the flow of oil becomes steady the wooden bar is held in the same position till the flow of oil starts decreasing at this stage the pressure on the upper log is again increased. The oil will again start flowing. The wooden bar is pressed till it touches the ground. The flow of the oil is allowed to cease, then the pressure is released slowly. The packet is taken out and unwrapped and *cibe* is taken out.

Pressing in Chappa requires about 15 to 20 minutes for one packet of seed meal containing about 2 to 2½ seers of the seeds.

SCREW PRESS

The screw press is simple and similar to hand fly press. There is one cage as shown in the figure.

The seeds are powdered and cooked as before. The cage is covered by a filter cloth from inside. Then the cooked meal is put in layers inside

the cage after each layer a metal sheet of similar size is put. Five to six layers are made and then screwing of upper plate allowed to move and the seed meal is pressed. Oil is allowed to trickle down after seizing of the flow of oil the pressure is again increased. The capacity of the press will be double than that of a chappa and ghani and time required for one operation is about 20 minutes.

SYLLABUS

Theory Lectures

1. Introduction and short history of soap making and the constitution of soap.
2. Classification of oils and acquaintance with non-edible oils, why use them ?
3. Raw materials and other equipment.
4. Comparative study of various processes of soap making.
5. Description of the process that is more suitable at villages.
6. Practical hints.

Practical

1. Preparation of soap by cold process.
2. Saponification of non-edible oils and separation of soap cake.
3. Final process of soap making by semi-boiled process.
4. Cutting, stamping and wrapping of the product.

(Each of these points are separately dealt below.)

1. Material used by men in old times—the name of inventor of soap making—gradual progress in the preparation of sodium carbonate in a pure form—oils or fats and alkali as the main ingredients of soap—other materails such as rosin, water, common salt, perfumes, colours, filler etc.

2. Classification of oils into three groups *viz.* (A) Vegetable oil (B) Mineral oil (C) Essential oil. Only vegetable oils can be used for soap making. They can be divided again into edible and non-edible oils. Daily requirement of a human being is five tolas of oil. While he gets only ¾ tola per day. If non-edible oils are used for industrial purpose, that much amount of edible oils can be consumed for human welfare. Various names of non-edible oil seeds and their places of growth.

3. *Raw material and other equipment* :—

(*a*) Various non-edible oils and also coconut oil because every good soap must contain 20% of it.
(*b*) Commercial caustic soda.
(*c*) Sodium silicate.
(*d*) Rosin of high quality.
(*e*) Common salt.
(*f*) Colours like soap yellow, green of I.C. Industries.
(*g*) Perfumes or essential oils like Lemon oil, orange peel oil, Sandal wood oil, Kevda.
(*h*) Ordinary water.

Equipment

(*a*) Shegri or furnace (*b*) ordinary Kadai, *i.e.*, soap pan (*c*) two iron or wood stirrers, (*d*) three mugs (*e*) wooden box whose walls can be separated (*f*) cutting wire (*g*) stamping die—for villages, the die of the type used in post offices will also do.

4. *Five processes of soap making* :—

(*a*) Cold process, (*b*) Warm process, (*c*) semi-boiled, (*d*) Grained process, (*c*) Settling or fitting process.

Their comparative study—cold and semiboiled processes should be used for soap making in villages.

5. Detailed study of cold and semi-boiled process as they are to be actually used.

6. *Practical Hints* :—

(*a*) Caustic soda is poisonous and have strong irritating action on skin. Store it in close iron or tin box. As far as possible avoid contact with skin.

(*b*) The amount of caustic soda required for each oil can be calculated from the tables.

(*c*) Excess of foam on addition of alkali to oil can be subsided by sprinkling water and thorough stirring.

(d) Stirring should be almost continuous throughout the process.

(*e*) The art of soap making depends upon the rate of consumption of alkali. Therefore add alkali in small batches successively.

(*f*) Perfumes are volatile substances. Hence they should be incorporated when the whole mass is cooled down.

(*g*) Apply oil to the walls of the wodden box before pouring the final product of solidification.

Formulae

Cold Process

Coconut oil	30%	Cotton seed oil	10%
Tallow	50%	Tallow	80%
Ground nut oil	20%	Cocoanut oil	10%
Silicate 25% on the total weight of oil.		Silicate 30% on the total weight of oil.	

Semi-boiled process

Neem oil	40%	Neem oil	50%
Cocoanut oil	30%	Cocium	20%
Ground nut oil	25%	Cocoanut oil	25%
Rosin	5%	Rosin	5%
Neem oil	25%	Neem oil	20%
Cotton seed oil	35%	Khanjkan oil	39%
Cocoanut oil	20%	Tallow	40%
Castor oil	10%	Rosin	10%
Rosin	10%		

For the Formulae of semi-boiled process 25 to 35% of silicate on the total weight oil may be used.

SYLLABUS FOR RURAL ARTISANS' (TELI) COURSE
VILLAGE OIL INDUSTRY

Preamble

DURATION OF THE COURSE : *2 Months.*

Mills and ghanis are the two sectors in the oil industry in the country. In the organised sector, it is reported in the 1951 census of India, that about 4.46 lakhs of ghanis are in existence. On account of the competition with the mills many of these ghanis are in a bad way and some oilmen are even leaving the profession to take up other lines of employment or remain unemployed. The object of this training is therefore, to revive the industry.

Training is required in working the improved ghanis, manufacture of improved ghanis, repairing existing ghanis, selection of oil seeds, technique of marketing oil and also organisational aspects of the industry.

Object.—Village Oil Industry is one of the age old industries of India with great potentialities as an agro-industry. Before the advent of rotaries and expellers bullock-driven ghanis were running almost in every village throughout the country catering to the fat requirement of man. Now the industry is facing a fierce competition from these organised mills. The traditional implements of the artisans are indigenous and not upto the mark to face the competition successfully. Their process of oil extraction is also a crude one. The industry is not well organised and passing through financial adversities. The artisans are ignorant of modern salesmanship. It is due to keen competition most of the oilmen have left their trade as this industry has proved inefficient in the competition against well equipped, well organised and well financed mills.

Government of India has always acknowledged the potentialities of this industry to provide fresh nutritive oil to people, fresh and healthy cake for cattle food and a great employment to (Oilmen) Telis in India. The development of this industry has been taken up by the Khadi and Village Industries Commission, which works with a view to making the industry most efficient to face the competition against mills, by providing improved implements, imparting training to oilmen, raising production and employment, and by organising the artisans in a cooperative fold. Therefore, the objective of this training can be no other than making the artisan capable of handling the improved implements efficiently, running the industry economically and to make the artisan fit for cooperative organisation, so that the industry may stand straight in competition against mills and provide more employment and a better standard of living to the artisans.

With these objectives in view, the training course has been formed keeping in mind the general educational standard and intelligence of the oilmen, so that he may grasp the training completely.

As the implements are improved and the processing has also been developed to a great extent, the course prescribed (enclosed) will be useful for training a new hand and in up-grading the skill of a traditional teli as well, as he will be using his past experience and knowledge when training is given to him.

The contents of the syllabus have been broken into details but as far as the method of training is concerned, it is not possible to draw such programme as it is purely practical, and is expected that a trained teacher will follow a general method of teaching.

The training is purely practical but the aspect of the industry is also dealt with so theoretical as to enable the trainee to take help of the books, etc., during and after the training.

Detailed list of equipment, hand tools and machines specially used for ghani industry is being given. The practical training is given by the practical teacher on the spot.

A unit is of two ghanis and two trainees may be trained on a unit and an instructor may instruct 15 trainees in one session.

SYLLABUS FOR RURAL ARTISANS' (TELIS) COURSE : VILLAGE OIL INDUSTRY

Duration of Course ; 2 Months

No.	Topic	Practical	Theory	Remarks, if any
1.	**Study of different main edible oil seeds of India and especially of that region in which the Training Centre is located.**	1. Inspection of edible oil seeds plants, and oil seeds, their different varieties (Wherever not available models and posters to be shown). 2. Time of sowing harvesting, Types and varieties produced, Geographical distribution.	1. Preliminary knowledge about main edible oil seed plants, groundnut, coconut, mustard, kardi. 2. Time, of sowing, harvesting season. 3. Yield of the oil seeds per acre (and per plant in the case of cocoanut and castor).	
2.	**Purchase of seeds.**	1. Study the working of local big and small markets (mandis) in respect of different types of oil seeds, their varieties and their market rates. 2. Inspection of some local godowns of the Govt. and of merchants.	1. Study of ten years production of different edible oil seeds in different regions of India. 2. Study of 10 years market rates of different types of edible oil seeds of different markets. 3. A study of varieties of oil seeds and their rates. 4. Factors effecting trade.	
3.	**Storing.**	3. Chemicals used as insecticides like Gamaxine etc. to be shown.	5. Marketing conditions of major oil seeds. 6. Collection of local oil seeds from peasants in the harvesting season. 7. Study of the rates of freight by different vehicles. 8. General study of godown building, general method of seed storing, precautions of preservation of seeds and chemicals used. 9. Protection of seeds from pests and insects.	

Village Oil Industry—contd.

Village Ghanis

S. No.	Topic	Practical	Theory	Remarks, if any
1.	Economics	1. To draw a budget for installation and running of a ghani unit; yearly, half-yearly & quarterly.	1. Brief study of installed capacity, its utilisation and production.	
		2. Costing of produced oil and cake.	1. Capital and employment. 2. Relative efficiency of improved ghani, Traditional, ghani and Mill. 3. Quality of oil and cake. 4. Costing of oil and cake. 5. Earning of a teli family. 6. General knowledge about the economic laws, regarding capital, labour, production, demand and supply, fluctuation of markets. 7. General knowledge of Sarvodaya economics. 8. Uses of ghani oil and cake.	
2.			1. General principles of Co-operation. 2. Study in brief, of the coop. movement in India. 3. Merits and Demerits of Co-op. organisation. 4. Problems and difficulties which this industry and co-op. societies of this industy are facing and their solution. 5. Features of a good co-op. society and defects which creep in during the operation.	
	General	1. Selection of bullock breed & age. 2. Assembling of ghani parts inspection of different parts of unassembled ghani and its fitting and installation.	1. Selection of bullock breed and age. 2. Assembling of ghani parts, inspection of different parts unassembled ghani and its fitting and installation.	

		3. Removing of common defects of ghanis during processing. 4. Yoking.	3. Precautions for yoking. 4. Common ailments of bullocks and their cure.
		5. Common ailments of bullock and their cure.	5. Bullock feeding and maintenance.
		6. Bullock feeding and maintenance.	
1.	Pre-Processing	1. Cleaning & Decoration of oil seeds by different processes involved.	1. History of processing of oil seeds. 2. A brief study of different tyes of processing.
2.	Processing	2. Processing of different types of oil seeds. (*a*) By traditional ghani. . . (*b*) Improved ghanis. 3. Different steps and stages of processing. 4. Precautions for processing for different oil seeds, defects during processing in the process and in the implement and their cure. 5. Maintenance of charts (records) of processing.	(*a*) Cold process & Hot process. (*b*) Rotary, expeller, Hydraulic press (elementary knowledge). 3. Theory and different methods of clarification and refining of oil. 4. Instructions for gradation of oil. 5. Precaution for storing of oil and cake. 6. General knowledge regarding agents affecting rancidity of oil and cake. 7. How to preserve oil and cake. 8. General principles of marketing propaganda and publicity.
	Note : One trainee should be able to run two ghanis at a time.	6. Inspection of rotary and expeller.	
3.	Post-Processing	7. Clarification and refining of oil. (*a*) Sedimentations. (*b*) Decantation. (*c*) Filteration. 8. Use of filter-Press. 9. Grading of oil. 10. Storage of oil and cake. 11. Packing.	9. Maintenance of Selling Agency. 10. Maintenance of general A/cs. of the Selling Agency and Trade. 11. Disposal of oil and cake

VILLAGE OIL INDUSTRY (TELIS COURSE)—*contd.*

S. No.	Topic	Practical	Theory	Remarks, if any
		12. Marketing 13. Maintanance of shop (Selling Agency) A/cs. propaganda and publicity.		
4.	Motor testing	1 Study of iron, mortar, its manufacturing process, and knowledge of its defects. 2. Testing of iron mortar.	*Note* : 1. As the course is purely practical, therefore, the candidates, should be instructed before every practical class about the precautions to be observed in work. They should also be given the knowledge of the theoretical aspects of the work before giving them practical work. 2. brief knowledge of Sarvodaya Philosophy	While imparting training the instructor should keep in mind the general standard of the trainees and he should simplify his instructions in the way to make the trainees grasp the course completely. He is not supposed to avoid the topics but may concise the subject wherever felt necessary.
5.	Fitting of facher	Fitting of facher in the iron mortar (at least three).		
6.	Installation	Installation of ghani.		
7.	Study of Oil Extraction	Taking of at least 30 charges (15 of soft seeds and 15 of the hard seeds) for extraction.		
8.	Removing of Ghani defects	To remove defects of Ghani's that may cause during the extraction, etc. (defects may be created voluntarily).		
9.	Conversion of Traditional Ghani	Conversion of at least one traditional ghani Improved ghani. (Each carpenter should prepare a set and he should be given the complete set, when he completes his training.		

SYLLABUS FOR GHANI CARPENTER COURSE: DURATION- 3 MONTHS

Object

Village ghanis are scattered in the villages of the country catering to the demand of people for oil. Traditional ghanis were manufactured as also repaired by Village Carpenters or occasionally by telis themselves. Even now the oilmen themselves repair their traditional ghanis. They replace pit and pestle when needed. But improved ghanis require special skill in the manufacture and repairs. In the absence of a trained carpenter improved ghanis cannot run smoothly and regularly. It has also been noticed that once an improved ghani is damaged due to wear and tear or due to some other reasons, it remains idle till a trained carpenter repairs it.

In order to manufocture the improved ghanis for supply to telis and to make them run smoothly and regularly, some traditional carpenters are needed to be trained according to the local requirement, so that they may manufacture and repair the improved ghanis and also be able to convert traditional ghanis into improved ones, in addition to meeting the other demands of the villagers.

The selection of the candidates should be made out of the traditional carpenters as purely a new hand is not supposed to complete this course within the period of three months.

Topic	Practical	Theory	Remarks
(1)	(2)	(3)	(4)
1. Study of ghanis improved and traditional and the implements used for manufacturing.	1. Scrutiny of improved and traditional ghanis and the measurements of their various parts.	1. A knowledge of the functions of various ghani parts in the extraction process and their technical importance.	
2. Wood Technology.	1. Study of the measurement and volume of the logs required for manufacturing various parts of improved ghanis.		
	2. Conducting tour for study of local trees used for manufacturing ghani for purpose of getting logs for ghani parts.	2. A preliminary knowledge of friction, leverage, bullock, draught, pressure and heat with respect to oil extraction.	
	3. Study of Transverse (cross) and longitudinal sections of different types of woods used for ghani.	3. A preliminary knowledge of important and other measurements breadth & length of various ghani parts with respect to oil extraction.	
	4. Study of different types of woods; and different elements of wood, strength, durability.		

(1)	(2)	(3)	(4)
	5. Study of wood fibres, their strength, arrangement and proper use.	5. Study of different types of natural and unnatural seasonal and their economic importance with respect to ghani industry.	
	6. Study of seasoned and unseasoned wood and their respective strength and durability	6. Precaution for log selection.	
	7. Knowledge of processes of wood seasoning (particularly natural seasoning).	7. Uses of bearings with respect to ghani and their advantages.	
3. Manufacturing of ghani.	1. Selection of logs for different parts of ghani.	1. Proper use of carpentry tools specially used for ghani industry and their maintenance. Use of hand lathe.	
	2. Manufacturing at least 3 complete improved ghanis by each candidate (at least one K.V. B' 57 model and another Wardha ghani with fitting of ball bearings.	2. Drawing of all templets used in ghani industry and their maintenance.	
	3. To manufacture at least one wooden mortar or to instal one cement or a stone mortar.		

LIST OF THE IMPLEMENTS USED FOR TRAINING GHANI MISTRY TRAINEE

	Rs. P.
1. Try Squere	2·50
2. Two feet folding rule	2·00
3. (*a*) Typical hand saw	3·00
(*b*) Saw big	20·00
4. Firmer wood chisel	3·00
5. Auger (big) of two sizes ½" and 1"	6·00
6. Jack Plane } 7. Cutting iron }	10·00
8. Pincer (with forked end)	4·00
9. Triangular slim tapered file or Saw file	3·00
10. Semi-round wood file	5·00
11. Wrench	3·00
12. Screw driver	2·50
13. Hammers' small & big	18·00
14. Oil stone	4·00
15. Outside caliper	2·00
16. Inside caliper	2·00
17. (*a*) Chisel with curved tip (long)	3·00
(*b*) Chisel (long)	3·00
18. Chisels small 2 pieces	1·50
19. Spirit level	2·50
20. Plumb line	1·00
21. Karani & Basule	3·00
(with one extra blade)	7·00
22. Axe	10·00
23. Basula	6·00
24. Basula semi-round edge	4·00
25. Hand bow drill	5·00
26. Table wrench	8·00
27. Templets	5·00
28. Wooden lathe	20·00
	169·50

LIST OF THE IMPLEMENTS USED FOR TELI ARTISAN TRAINING

1. Hand stirrer (wooden)	These are supplied alongwith ghani and their cost is included in the price of ghani
2. Crow bar	
3. Iron rod	
4. Tins and tray	
5. Scale & weights.	
6. Buckets.	
7. Iron shovel.	
8. Strainer.	
9. Ropes.	
10. Water measures.	
11. Improved ghani with accessories.	

VILLAGE LEATHER INDUSTRY

SYLLABUS FOR RURAL ARTISANS COURSE

(Flaying & bone digesting etc.)

PART—I

The duration of this course *viz.* Carcass recovery is of four months and there would be two to three terms according to the convenience of the Institutions imparting training per year.

OBJECT

According to the rough estimate of the total livestock population of the world, India maintains about 1/3rd of that and of this there are about 180 million cattle heads. Calculating on the death rate at 9% there will be an estimated death of 20 million cattle per year. Out of these total deaths about 10% are due to slaughter mainly for meat purposes, the rest die naturally. It has been observed that carcasses are not attended to in time and at times, they are allowed to putrify. This occurs mainly due to negligence and other conditions which prevail in the villages where majority of the cattle die naturally. According to the present practice, the dead animals are flayed only for the purpose of hides. The carcass is then left to the vultures, dogs, jackals, etc. thereby causing insanitation and loss to the country due to non-recovery of the other important components. This loss to the nation out of the non-recovery of various components of the carcasses such as meat, bone, tallow, etc., is roughly estimated to Rs. 7 crores annually, whereas an additional loss of Rs. 3.5 crores is sustained on account of defects in hides and skins due to late attending to the carcasses, careless and bad flaying and improper curing and preserving of hides and skins.

The main object for implementing such scheme for training in carcass recovery is mainly to train up youth in the art of carcass recovery which includes correct methods of flaying, curing and preservation of hides and utilisation of various components of carcasses. This may minimise the enormous loss sustained at present by the nation. The trainees are expected to attain the standard of knowledge on completion of this course to attend to the work mentioned above and to be capable enough to propagate the new theory in this regard amongst the community in villages for undertaking this type of work.

If the carcass is dragged, study for the location of centre in view of easy transportation of carcass all the year round.

SYLLABUS

Duration of Course : 4 *months*

Topic	Practical	Theory
1. Primary care of carcasses soon after the death of the animal dragging and its harmful effect upon hides, means of its transportation to the Recovery Centre.	Study of each skin after being taken off the carcass, effect of bacteria and enzyms on it if flaying operation is prolonged. Effect on grain side.	Study of various diseases due to which cattle die. Their effect upon hides and skins, effect of various bacterias on them after the death, need of immediate flaying

Topic	Practical	Theory
2. Flaying	Correct lines of rigging and opening the carcasses, method of using Platform or in hoisted condition or such arrangements, methods of flawless removing of hides, use of improved tools and equipments in flaying.	To study importance of preserving shape of hide thus removed, without flaying cuts or scores which devaluate the material. Different methods of flaying adopted here and in other countries, care of grain during operations.
3. Curing and preservation ..	Post-mortem changes in carcasses and effect on quality of hides, removal of flesh and fat from the hide, washing and draining of hides prior to curing, framing of hides and use of different curing agents, use of arsenic and other insecticides.	Effect of unremoved fat and flesh on the portion during storing and during tanning process, need of properly washing in clean cold water and draining to remove excess of water before salting, dry salting, drying in unstretched condition, drying on frames with hooks and ropes. Poisoning with arsenic when the material is to be kept for a long time or transported to distant place.
4. Recovery of carcass components.	Recovery of components of carcasses, boiling, recovery of fat, separation of meat and bone, drying of cooked meal, digestion of bones for bone manure, crushing of manure, different methods of producing manure from raw bones, use, maintenance and care of bone digester, clarification or refining fat by various methods such as bleaching by sun in shallow trays and with chemicals, deodourisation by exposure to sun. Its use in manufacture of soap, industrial greases, glycerine, fatty acids and candles, etc., disposal of horns and hoofs for making toys, combs, nets, foot oil and manure, recovery of putta for the preparation of guts.	Theory of necessity of chopping the carcasses for separation of bone and meat by boiling with the advantage of removing fat which floats on the upper layers in the pan, use of wash which has high percentage of nitrogen, complete drying of cooked meat and use as manure in crushed form. Need to further cook the bones in closed vessel like bone digester. Fundamental knowledge of fertilizers and the important role played by meat and bone manure. Their composition and use on different crops, plants, etc.
5. Preparation of glue and use of Intestine.	Glue making from the trimming of hides and skins and other waste such as water from cauldron lined pieces from tannery.	Broad outline of glue manufacture.

Topic	Practical	Theory
6. Recovery of Carcass components.		
(*a*) Separation of components.	Chopping of the carcass, boiling of chopped parts with water. Recovery of Fat on cooling Separations of bones and flesh.	How to separate meat and tallow from carcass.
(*b*) Flesh Manure ..	To drain out water from the cooked flesh. To remove the remaining water by evaporation Powdering of crushed flesh.	Use of manure in different forms Chemical constituents of the flesh manure—How to use for agricultural purposes.
(*c*) Bone Manure ..	Drying of bone, making small pieces of bones by use of hammer, operating the digester, drying of cooked bones, powdering of dried bones, grading the powder by passing through different mesh.	Use of bone manure in different forms. Chemical constituents of bone manure. Advantage of organic manure. Different methods of preparing bone manure.
		Principles of working of the digester and its functions. Costing of manures.
		Economic working of the process.
(*d*) Preparation of Soap from animal fat.	How to purify the fat.	Uses of fat.

SYLLABUS FOR TRAINING COURSE IN FLAYING AND BONE-CRUSHING

Lesson plans :

Part I—*Scientific flaying and its principles.*

The removal of the outer covering of any animal whether slaughtered or dead is termed as flaying and the method of skinning with proper flaying knives in a scientific manner is called scientific method of flaying.

Part II—*Wrong methods in flaying.*

Cuts, scores and gowges effected when the skin is being removed from the carcasses are generally caused by inexperienced operators or use of kitchen or sheath knives instead of the standard flaying knives and further the use of incorrect ripping lines by the flayer is responsible for producing a bad shaping or lop-sided pelt. This method of crude flaying produces a bad pattern hide.

Part III—*Precaution to be observed prior to flaying.*

If the dead animal is thrown off on the open grounds, the hide or skin whichever is the case will be damaged by vultures, crows, dogs etc. resulting in a loss to the leather industry, the economical conditions of the chamars and the national wealth. The components of the body from which by-products can be got are also lost. The dragging of the carcass on the ground results in the abrasion of the hide or skin and thus hampering the tanners in getting quality hides. If timely intimation is not given after the death of the animal, the putrefaction starts and spoils the hide.

Part IV—*Definition & the method of curing.*

Flayed hides and skins are subject to rapid putrefaction especially in hot climates. To prevent this, putrefaction, damaged hides and skins have to undergo treatment called curing.

Part V—*Types of by-products obtained from carcasses.*

Bonemeal : Bones are digested in a bone digester under pressure and can easily be powdered to make rich phosphatic bone meal. During the process of digesting, tallow and glue water would be available only when bones are fresh. Finished marketable glue can be prepared from the glue water by further indirect heating. (1) steamed bone-meal; (2) raw bones; (3) sterished bone meal—are the three types of bone meals.

Steamed bone meal is manufactured in Bone Crushing units. It contains 1% to 2% of nitrogen and 25% to 30% phosphoric acid. It is used as manure on crops.

Blood meal is used as manure on crops as it contains 10 to 12% nitrogen and 1 to 2% phosphoric acid.

Flesh manure used as manure on crops contains 10.49% nitrogen, 45% phosphoric acid and 0.45% potash.

Tallow and fats used in soap candles etc. manufactured and as lubricant in leather and textile industry.

Hoofs used to manufacture glue buttons, tooth piks etc.

Horns used for manufacturing combs, buttons, fancy articles etc.

Tail hair used for brushes, curled hair for upholster etc.

Cuts and intestine waste used for carding bows, tennis and badminton rackets etc., and sterilised guts are used in surgery.

Dung used as manure straight as it is taken out for after drying in the sun, or fuel gas can be made out of cow-dung.

Part VI—*Types of flaying knives used.*

Sharpener knife, hammer axe, curved knife and flaying knife. These knives are made of surgical steel and these knives will not get rusted.

Part VII—*Main appliances used in the manufacture of by-products.*

Cauldron : This is a vessel resembling 'Anda' in which after flaying the heaps of meat with bones are put into for boiling. By boiling for a long

time, the fat separates and floats on the surface of the water. By the very process of boiling the meat gets separated from bones. This separation is necessary for subsequent processes. This vessel should be of sufficient size to hold all the meat and bones put into it and yet leave some space over it.

Frying pan : It is a rectangular sheet of flat iron with ridges on all sides to prevent the matter from falling while frying. The pan is fired from bottom, the mass kept moving from the far end towards the firing end. The firing is done with the help of an iron rod at the end of which there is a flat piece of iron about six inches long and also with the help of a rake. This rake is an instrument with teeth or pins. Any tool consisting of a blade at right angles to a long handle is called rake. During frying, the bones get separated. These should be picked up from the pan and collected in a heap on the floor of the room and another charge put on until the entire quantity is done. The pan has to go on working without stoppage after the meat is taken out of the cauldron till the entire lot is finished, otherwise the meat will get rotten and destroyed.

Exercises :

Part I—*Scientific flaying and its principles.*

The carcass is allowed to lie on its back on the ground and then flayed. Provide the carcass sides with wooden blocks to prevent from falling and now the body lies slanting with the weight distributed on to its horns. This will help the hide in not getting in contact with blood. If stones are used instead of wooden blocks, they will prick the hide and spoil the grain of the hide.

Don't make slits as you like with crude knives. Simply make a slit along the centre with modern flaying knives, starting from the under lip down the throat, breast, belly and finish at the tail. Then a cross slit is made across the breast right down to the joints of the two fore-legs. A similar cross slit is made at the lower part of the abdomen down to the joint of the hind legs. Then the hide is peeled off by the hand cutting the white membrane with a knife on the under side of the hide at places even hard by hand or fisting. The use of the knife has to be made very carefully by the flayer otherwise, the hide may cut through, making holes or deep knife scores on the flesh side. This will bring down the value of the hide to a great extent.

Part II—*Wrong methods in flaying.*

Do use knives for flaying but see that the knives are of standard size and are scientifically approved flaying knives. Always make correct ripping lines as mentioned above in the scientific flaying and its principles.

Don't be over zealous in the removal of the fat and meat. Cardess process, very often results in the cutting away of valuable leather making substance. So, you must see the standard of flaying knife, like sharpener knife, flaying knife, curved knife, hammer axe etc.

Do not spoil the hide by allowing the flesh to remain in tact with the hide knowingly while flaying in order to give more weight to the hide while selling. This method will give way to putrefaction of the hide and deterioration in quality.

Part III—*Precautions to be observed prior to flaying.*

Do inform the chamars and the public to intimate to the flayer that the animal is dead and should be removed. Enlighten the chamars that throwing away of the carcasses will lead to certain types of contagious diseases if the animal is dead with certain diseases, vulture, crows etc. will puncture the hide and thus hamper the flaying. Show the public the products obtained from the body of the carcasses just to make them know that such useful by-products should never be wasted. Show them by demonstration the defects obtained the hides dragged on the ground. Demonstrate transport of the carcass on poles required places as the correct method. Make the public and the 'vettians' know that late intimation leads to putrefaction. Don't merely explain but demonstrate and do propaganda and convince the people to co-operate in this task to develop the leather industry.

Part IV—*Definition and the method of curing.*

Hides have to be perfectly cleaned (washed immediately after flaying). The best way to do this is to spread the hide out on the floor and to wash it perfectly with a hose pipe. A brush or a hard broom should be used to scrub all the blood from the hide. If running water just use buckets and enough water to get the hide perfectly clean. Dung and dirt on the flesh side also have to be washed out. Cleaning of skins is easy. Just wash the skin in clean water.

Hides and skins are piled on a wooden frame about 3" above the floor. Each hide must be carefully and completely covered in such a manner that the flesh side is on top. If the hides and skins have to be kept for a certain time, they have to be repiled and resalted. The way to do it is to start another pile and to place the top hide from the first pile at the bottom of the second pile and to resalt it, placing the other hides on it so that finally the hide that was at the bottom of pile No. 1 is on top of No. 2. Fresh salt is used for salting.

Part V—*Types of by-products obtained from carcasses.*

The variety of uses put of by-products from carcasses which would otherwise go to waste should be explained and demonstrated pointing out the conversion of waste into wealth.

Part VI—*Types of flaying knives used*

Don't keep the knives idle after flaying is done. Wash the knives cleanly and wipe out with a cloth to keep the knives ready for flaying when required.

Part VII—*Main appliances used in the manufacture of the by-products.*

Cauldron : Take the cauldron, clean well and pour water into it. Put the out bits of the carcass into it and boil them. After some time, take the flesh and the bones. The fat is removed separately and kept for sale. Very often shake up with a ladle to have even boiling in the cauldron and the lid should be covered while boiling.

Frying pan : Flesh bits are squeezed, dried a little and then put on the frying pan, start moving the flesh while getting fired from bottom with a rake for even frying. After frying is over the flesh meal is obtained and preserved and sold for use as flesh meal for agricultural purpose.

LIST OF TOOLS & EQUIPMENT

1. Opener.
2. Flaying knife.
3. Sharpener.
4. Hammer one.
5. Curved knife.
6. Cauldron.
7. Frying pan.
8. Meat squeezer.
9. Bone digester.
10. Bone crushing arrangement.

VILLAGE LEATHER INDUSTRY
SYLLABUS
PART II

Part II—*Training in tanning* (Duration—One Year).

Object : The main object of this training is to impart knowledge in Tanning of hides and skins either recovered from carcass recovery units or purchased from village tanners. From the flaying units the major and most important product with respect to Leather Industry is raw hides and skins. It is very important to train the trainees in the different methods of processing of raw hides for different types of leathers. The Training Centres sponsored by the Khadi and Village Industries Commission for giving such training in Tanning mainly train people from different communities and specially from the hereditary tanners community so that in villages they can further process the raw hides obtained from that area by modern methods with the use of indigenous tanning agents as far as possible.

TRAINING IN TANNING

Topic	Practical	Theory
1. History of tanning industry, histology of hides and skins. Behaviour towards different materials, different types of hides and skins available in India, hard and soft water, methods of softening of water.	Elementary knowledge on chemicals control of various process and maintenance of tanneries.	Broader definition of tanning its importance being the first industry from pre-historic times. Histology of hides and skins of different animals, their chemical composition, behaviour towards different chemicals *i.e.* acids, alkalis and ovides and other tanning materials. Hides and skins available in India and their resources of supply and characteristics, curing and preservations of hides. Tannery waters—difference between hard and soft water and their effect on tanning, methods of softening water.

TRAINING IN TANNING—(*continued*)

Topic	Practical	Theory
2. Soaking, depilation, deliming.	Same as in item No. 5	Soak of hides and skins in different conditions *i.e.* green, wet salted, dry salted and dry with and without use of soaking agents. Objects and deliming with chemicals and ferments—their methods, Bates and their uses, puring, drenching and scudding.
3. Pickling and Tanning ..	Same as in item No. 5	Object of pickling, pickling (*i*) chemicals and their effect upon pelts.
4. Different types of tanning	Same as in item No. 5	Principles of tanning, different processes of tanning such as Alum tanning and tanning, Formal-de-hyde tanning, oil tanning, chrome and vegetable tanning.
5. Finishing of leather, stuffing and drying of leather, tannery bye-products.	The practical training in most of the above processes will be taught in the tannery on a Semi-commercial scale, by the technical staff attached to the Institution, working on the local hides and skins which are of commercial importance in the area. The students will be asked to manufacture the following varieties of Leathers (*i*) vegetable and chrome sole leather, (*ii*) suitcase leather, (*iii*) Harness leather, (*iv*) vegetable tanned light leathers such as morocco, book-binding, and lining leather out of goat and sheep skins, (*v*) different kinds of laces, belts etc., (*vi*) alum tanned leather, (*vii*) chrome sheep skins, (*viii*) East India tanned skins and (*Ix*) East India tanned goat and sheep skins.	Different types of dyes, used in leather industry their properties and use in leather dyeing, mordents and strikers, their uses and effects, stuffing and fat liquering, different types of fat liquering materials, methods of preparation and application to different types of leathers, drying of leather and control of humidity, different types of finishing materials, properties and uses of Egg albumin, blood albumin Gums resins, case in, pigment finish seasons and nitrocellolose lacquers.

LIST OF EQUIPMENT FOR FLAYING & TANNING

Flaying tools ;	*Price in Rs.*
1. Opener 2. Flaying knife 3. Sharpener	Rs. 14/- per set (packing and forwarding charges etc.)

The above set is available from M/s. V.A.P. Corp. Ltd., 208-Ghodbunder Road, Santacruz West, Bombay. The above 3 items can also be made locally out of the best steel at cheaper rates.

4. Axe : This can be had locally which may not cost more than Rs. 5/- each.

Tanning Tools ;	*Prices in Rs.*
1. Moon knife	5/-
2. Slickers (either glass or copper)	7/-
3. Curriers knife	30/- to 35/- each
4. Bate Beam Stone	7/- each.
5. Skin softener	12/- to 15/- each.
6. Cork (arm) Grinder Board	10/- each.
7. Worker Board Flesher	12/- to 15/- each.
8. Staking Stand	10/-
9. Staking blade	5/- to 7/- each.
10. Rub Stone	7/- each.
11. Line plunger	10/- to 15/- each.
12. Monitor Flesher	25/- to 30/- each.
13. Spring (German style) Flesher	30/- to 40/- each.
14. Liming pits	
15. Back pits	

LESSON NOTES ON TANNING

Topic

History of the Industry, histology of hides and skins. Behaviour towards different materials, different types of hides and skins available in India. hard and soft water softening of water. Soaking—depliation, deliming—Pickling—Tanning—Various types of tanning—finishing, drying, utilisation of tannery bye-products.

Practical

Knowledge on chemicals—control of various process and maintenance of tanneries—Practical training in all processes—Manufacturing E. I. Kips—Chrome tanning—Bark tanning by pit system—producing various types of leather—alum tanning—formaldehyde tanning.

Theory

According to the theory of evolution man in primitive stage was habituated to hunt animals for meat. After assessing meat he used remaining body coverings of animals as clothing to protect his body from sun, rain and cold. In course of time he learned to rub the tallow he had got from the animals he hunted on the hides to make it water proof and some what pliable and soft. Once he found accidentally a hide carelessly left by him in a pond was softened by having got contacted with some bark liquor formed both from broken branches and leaves of some trees due to rain and storm. He thought that the hide got tanned by the bark liquor was some what better than that of the tallowed hide. By having acquired, some knowledge of vegetable kingdom he was convinced that it will be better if it is treated with bark liquor and that it can be used as a garment. Thus tanning has

slowly progressed to the present stage, step by step having different types of tannages such as chrome and others; thanks to various inventors and scholars. It is the industry, next to textiles. India is the largest producer in all sorts of leathers due to its rich cattle wealth. India exports nearly 60 crores worth of tanned leather and about 9 crores worth of raw hides and skins. About 5 million people are connected with this industry. Hides and skins are tanned mostly in all States by organised factories and unorganised units. South India has about 600 tanneries which tan mainly through bark tanning processes. Uttar Pradesh has got maximum leather workers who do their tanning in their courtyard. It is famous for its high quality leathers from organised big factories. Calcutta produces a major portion of chrome tanned box sides utilised in India. Punjab is famous for bag tanned hides. Madhya Pradesh has not adequate tanneries to tan raw hides available in that State. So it exports the raw hides to Madras. Andhra also falls in the line of Madhya Pradesh in this respect, even though it has a normal cattle wealth and raw materials.

Leather trade and industry was confined to a particular class of people who came to be known as chamars. They are socially depressed and economically backward. These millions of people are probably considered untouchables.

General

This industry can be divided into four aspects.

1. Pre-tanning *i.e.* proper flaying and utilising the different components of carcass, 2. tanning by different processes, bark tanning, chrome tanning, alum tanning, iron tanning and formaldehyde tanning, 3. Manufacture of Leather goods, like shoes chappals, purchase bags, utilities and industrial products, 4. Manufacture of allied products like Glue, Gelatine, guts soaps etc.

Potentiality of raw materials

India is the largest producer of hides and skins in the world. Its production of hides and skins are estimated as follows :—

Animal	Livestock in millions	million
1. Cow hides buff hides.	1938	20
2. Goat and sheep skins.	86	27–4 &
3. Horse, mule & donkey.	27	17

Out of this production in hides 85% of them are collected from naturally dead animals, whereas the balance 15% are from slaughtered animals. Death rate as roughly estimated will be 10% annually of the total population.

(Bark tanning)

Soaking : It is the first major operation and its objects are to remove the adhering blood, dirt and other impurities so as to bring them into the original condition. In case of wet salted goods, 4 or 5 charges of water is given. For dry salted goods overnight soaking is required. About $\frac{1}{2}$% to $\frac{1}{4}$% of sodium sulphide or caustic soda may be used. For chrome tanning of furskins, carbolic acid $\frac{1}{4}$% to $\frac{1}{2}$% may be used. Some time commercial wetting agents are also used, *viz.* Detergent telpot.

After soaking, the goods are derived and taken for liming. The object of liming is to remove hair, flesh, swell and plump. There are two methods of limings (i) long liming (ii) short liming. The former consists inverssing hides and skins in an old lime liquor, strengthened with 15 to 17% of lime. Daily the goods are handled and on the 9th day they are dehaired. In the same day, a fresh lime liquor is prepared with 20 to 25% of lime and goods are kept for a week in the liquor, then fleshed and scudded.

Short liming

For the manufacture of chrome leather, (generally) stiffer leather, this method is considered to be best and in this 1% sodium sulphide or arsenic sulphide is used along with sufficient lime and water to make a paste. The paste is applied on the flesh side. The next day skins are unhaired and the process is fresh lime liquor adding 15% lime. The goods are daily handled and on the 7th day, they are fleshed and taken for deliming. It is treated with 1% boric acid or 1% ammonium sulphate till the goods are free from lime. Usually this operation takes one full day by pit method but one hour in rotating drums.

Bating

It is an operation in which pigeon-dung is used. It softens down bad skins and produces silky grain effect. But now-a-days ready made artificial bates are available in markets ¼% to ½% may be used on pelt weight.

Drenching

It is a treatment of bated skins with an infusion of bran. It follows the bating and cutting operations. Its objects are to complete removal of lime and slightly bring the skin on acid side. About 10% wheat bran is dissolved in hot water. A day prior to use in such liquor, the goods are processed ½ to 1 hour.

Pickling

It is a process after bating and drenching. The goods are treated with 10% salt, 1% sulphuric acid, 150% water—Pickling widens the gaps formed by the liming process and thus the fibres are further separated in this process. Pickling facilities are speedy and ease tanning.

Alum pickle

100% water, 10% salt, alum are used. Hides for chrome tanning are pickled in this liquor for a week or ten days.

Vegetable tanning materials

Avaram, konnam, wattle bark, wattle extract, babul, goran etc.

Tanning

Before the commencement of the tanning process, the barks selected one Avaram, wattle extract and wattle bark. The total amount of bark required for tanning is ascertained on the basis of flesh weight. Usually 1½ to 2 lbs. of bark are required for every lb. of expected leather. The barks are mixed and the tan liquor is prepared with some old tan liquor, 24 hours before the commencement of the process. After complete deliming the goods are transferred into tan liquor handed for 7 days. On the

5th day the hides are washed on the beam flesh side to remove loose unfixed tannins in water. The barks are sprinkled inside the pit, the hide is laid with the flesh side down and another layer of bark chips are sprinkled and so on all the hides are treated finally keeping the top hide grain side down and flesh side up. On 8th day the hides are again marked with blunt knife on beams and a second bark removed and fresh barks are used (Konnam and avaram). The object of using two barks is to get light colour on finished leather. Daily the goods are handled and as usual the barks are sprinkled in between the hides. The completion of the tanning process takes 20 to 30 days for hides. After completion of tannage they are ready for bleaching. To get pale colour myrabolum powder are given, about ¾ measures of Myrabolum powder is required for each hide. Liquor is prepared in sufficient hot water which helps the extraction of tannins. The hides are kept in this bark for 4 days, then they are beamed, oiled with groundnut-side, semi dried and set. Setting is done to remove wrinkles and also to flatten the grain.

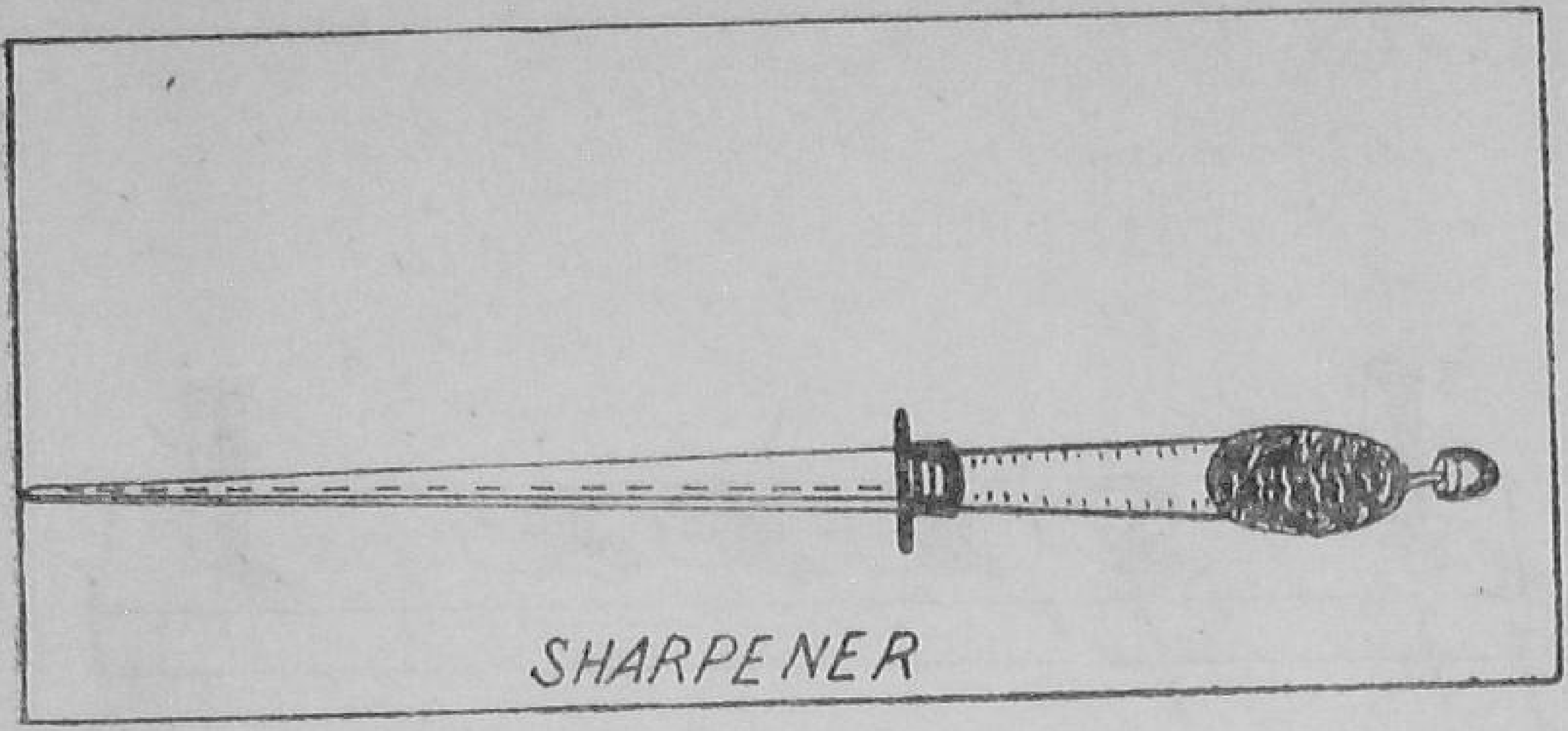
Chrome Tanning

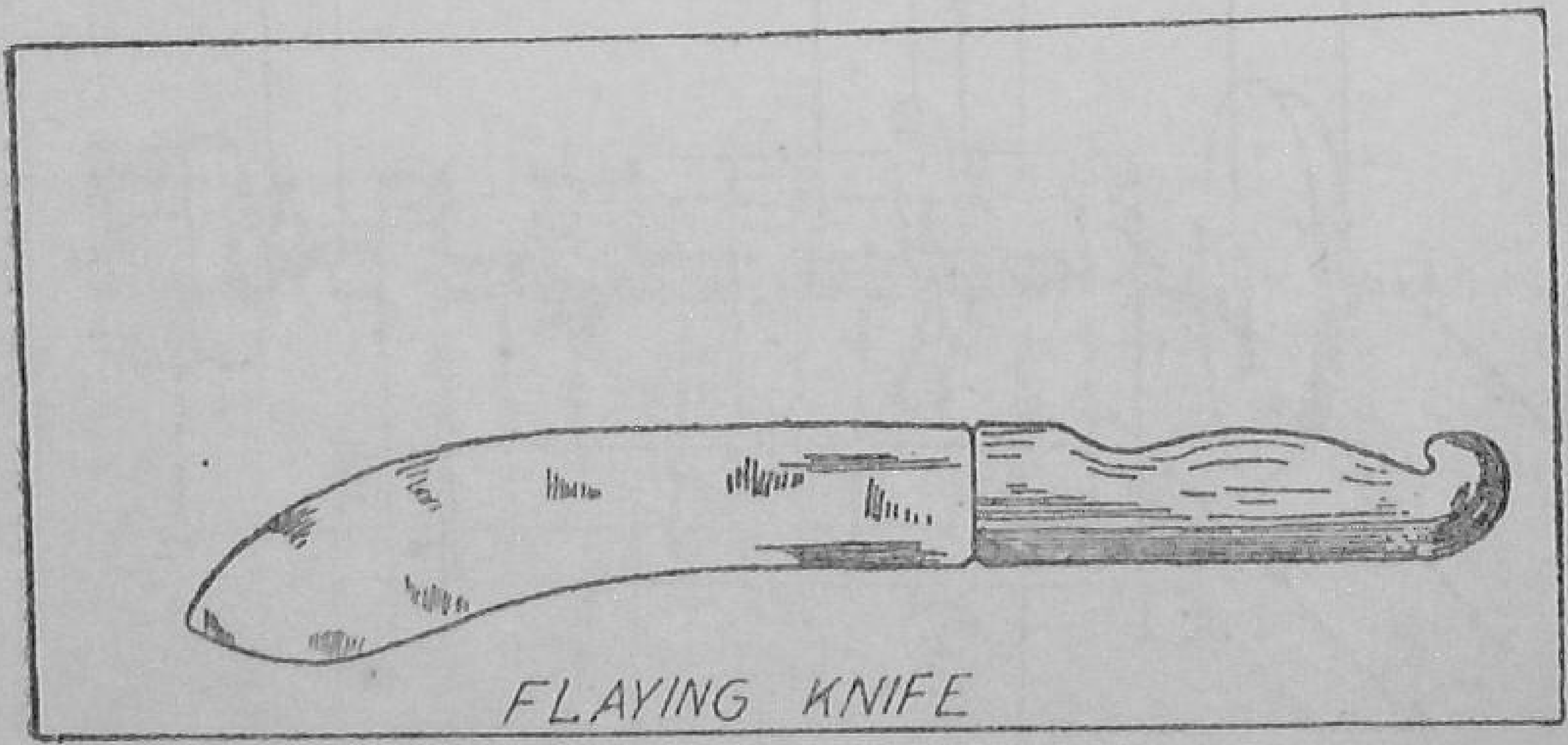
It is a process in which pickled goods are treated with basic chromium salt. This is prepared by one bath chrome liquor. 100 lbs. of sodium Bichromate, 100 lbs. of sulphuric acid and 30 lbs. of jaggery or glucose, and made up to 100 gallons of water. Chrome liquor can be prepared in wooden rats, first Bichromate is dissolved in hot water, after completely dissolving it is slowly added—Constant steaming is essential for mixing these two chemicals. After complete addition of the acid slowly jaggery is added in small chips to the acid bath. At this stage violent reaction takes place but the addition of jaggery should be continued till the chemical action is stopped. Now the colour of liquor will be seen in bluish green colour. The prepared liquor is diluted and allowed to settle down for few days before use, (10 days).

Formaldehyde tanning

It is popularly known as white tanning. The skins which are usually tanned by this process are of snakes, rep'iles and pythons. The skins are short limed without using sodium sulphide for 4 or 5 days fleshed, delimed with boric acid and pickled with 5% alum and 2½% salt. The pelts are handled for a week in the pickled bath, then 1 to 1½ oz. of formaldehyde is added and the goods are allowed to remain in this liquor for more than 15 to 20 days. After this period small addition of soda ash is given and further handled. After tanning the skins are treated with Ammonium Sulphate, about ½% to 1% is used. The goods are then liquored with good quality of turked red oil and china clay for over one hour. The skins are hung up to dry. The dried skins are staked and finished with milk, egg on the grainside dried and glazed.

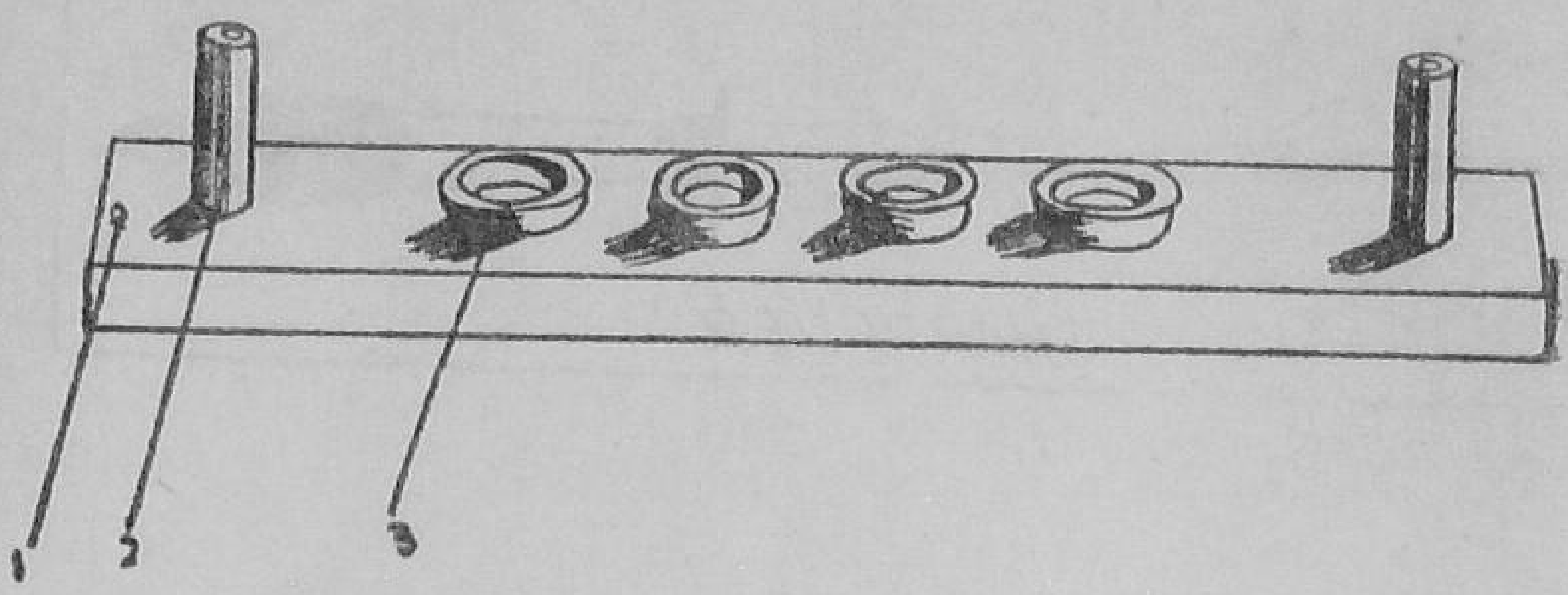
Details of the process to be given by the Instructor who is trained for the purpose in the training institutes of the Commission.

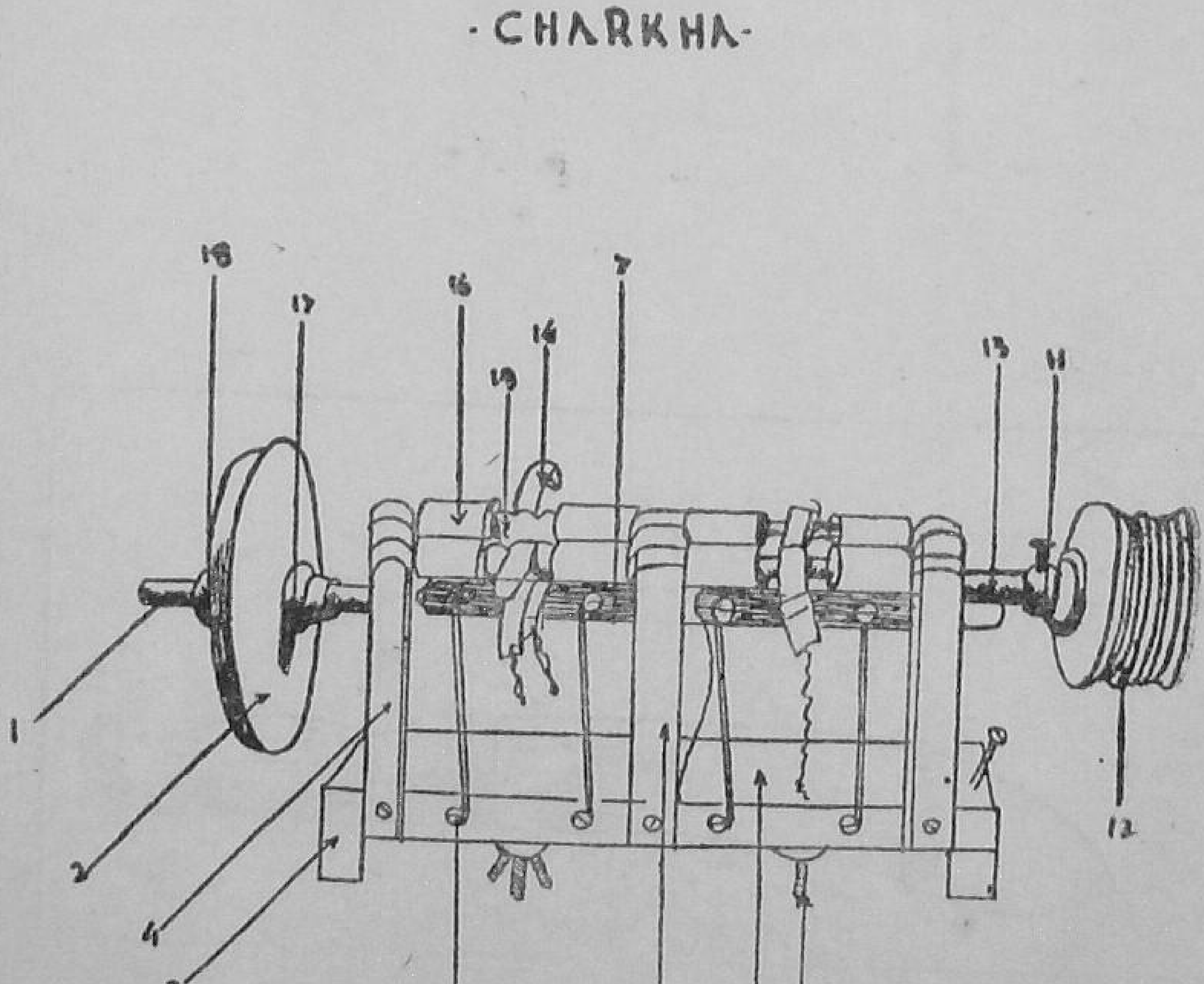




11. Flaing Bone digesting and tanning of Leather

CHARKHA





1. Hand Spinning

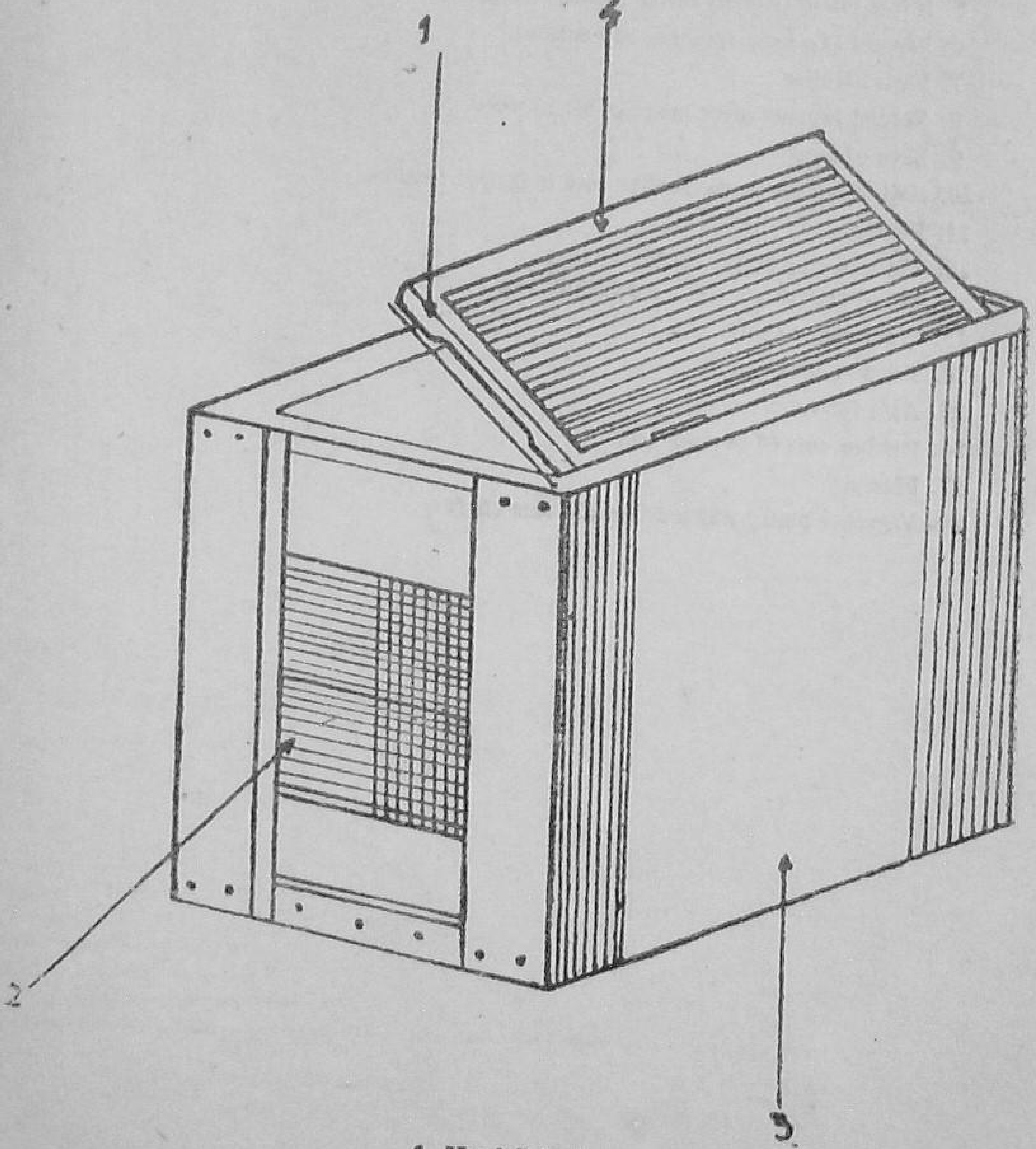
SPINNING RING RAIL

1. Rail made of sisam wood
2. Feeding Tube (Barni Nali)
3. Ring

SPINNING MODHIA

1. Fluted bottom roller shaft
2. Pulley on bottom fluted roller
3. Adjusting Piece for keeping spinning Modhia in proper angel
4. Bearing piece made of sisam wood
5. Sliver Hook (Khadi) Sliver passes through this hook
6. Fly nut (To keep spinning in Tension)
7. Fluted Roller
8. Second bearing piece made of sisam wood
9. Bare of modhia
10. Bolt which keeps the rubber cots in proper tension
11. Flange
12. Wooden step pulley on front roller
    with 4 grooves, 3 3/4", 3 3/8", 3" and 2 1/2"
13. Front roller shaft
14. Tension hook (kadi)
15. Axle for rubber cots
16. Rubber cots (8 in numbers)
17. Flange
18. V-groove pulley which drives the cam chaft

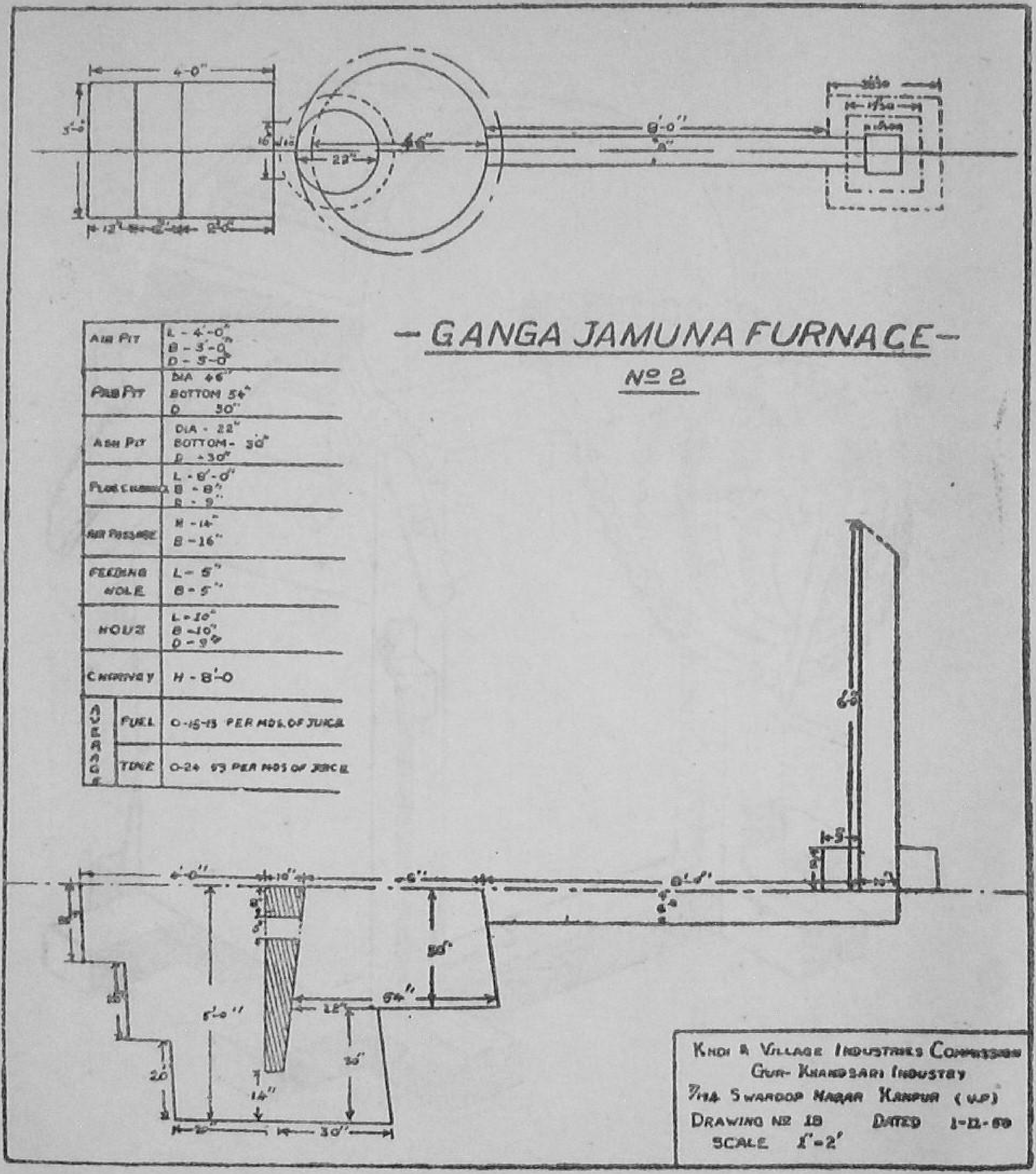
- DHUNAI MODHIA



1. Hand Spinning

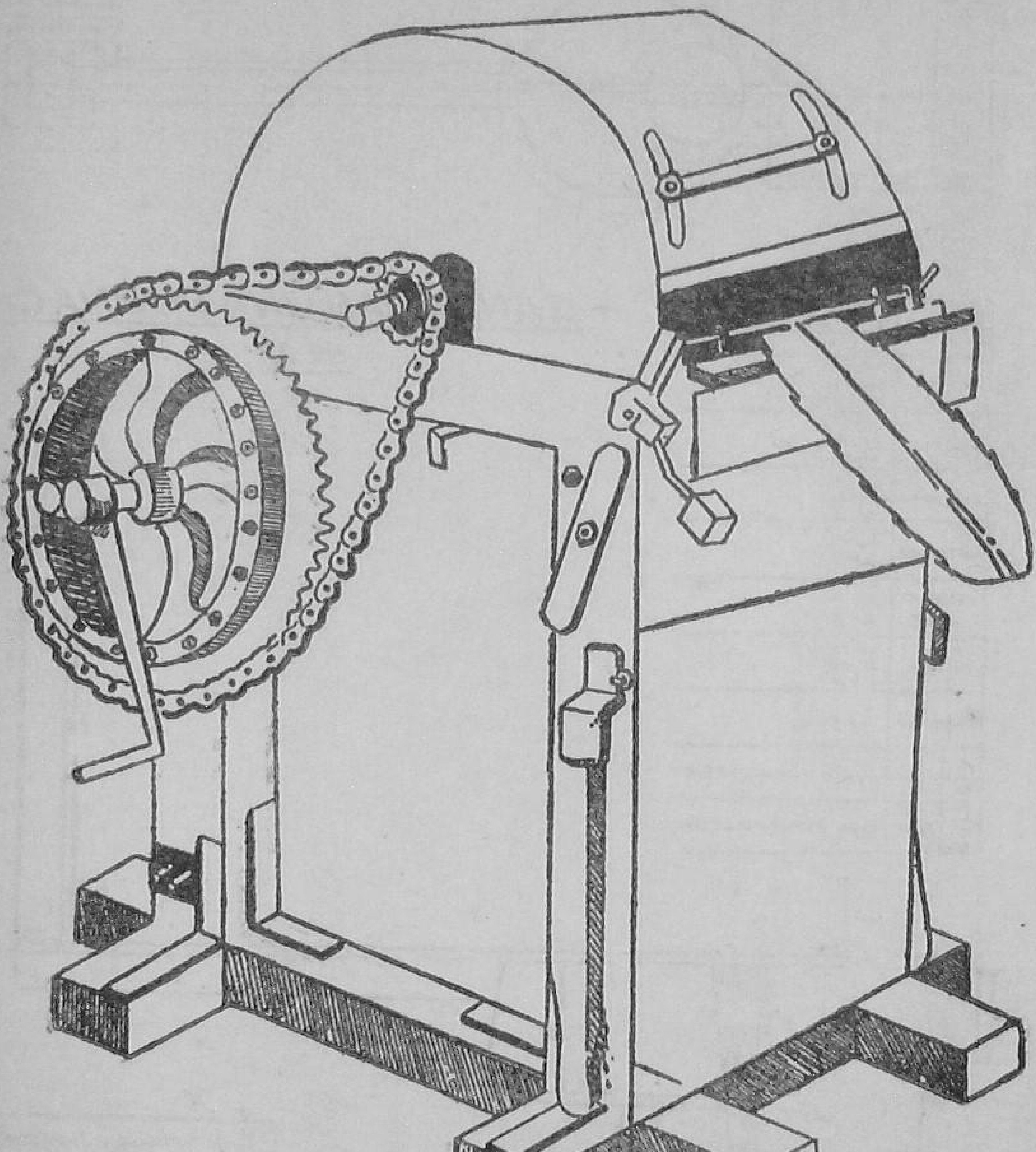
POLE PERI

1. Top Lid.
2. Mouth of Pole Peri
3. Net
4. Handle

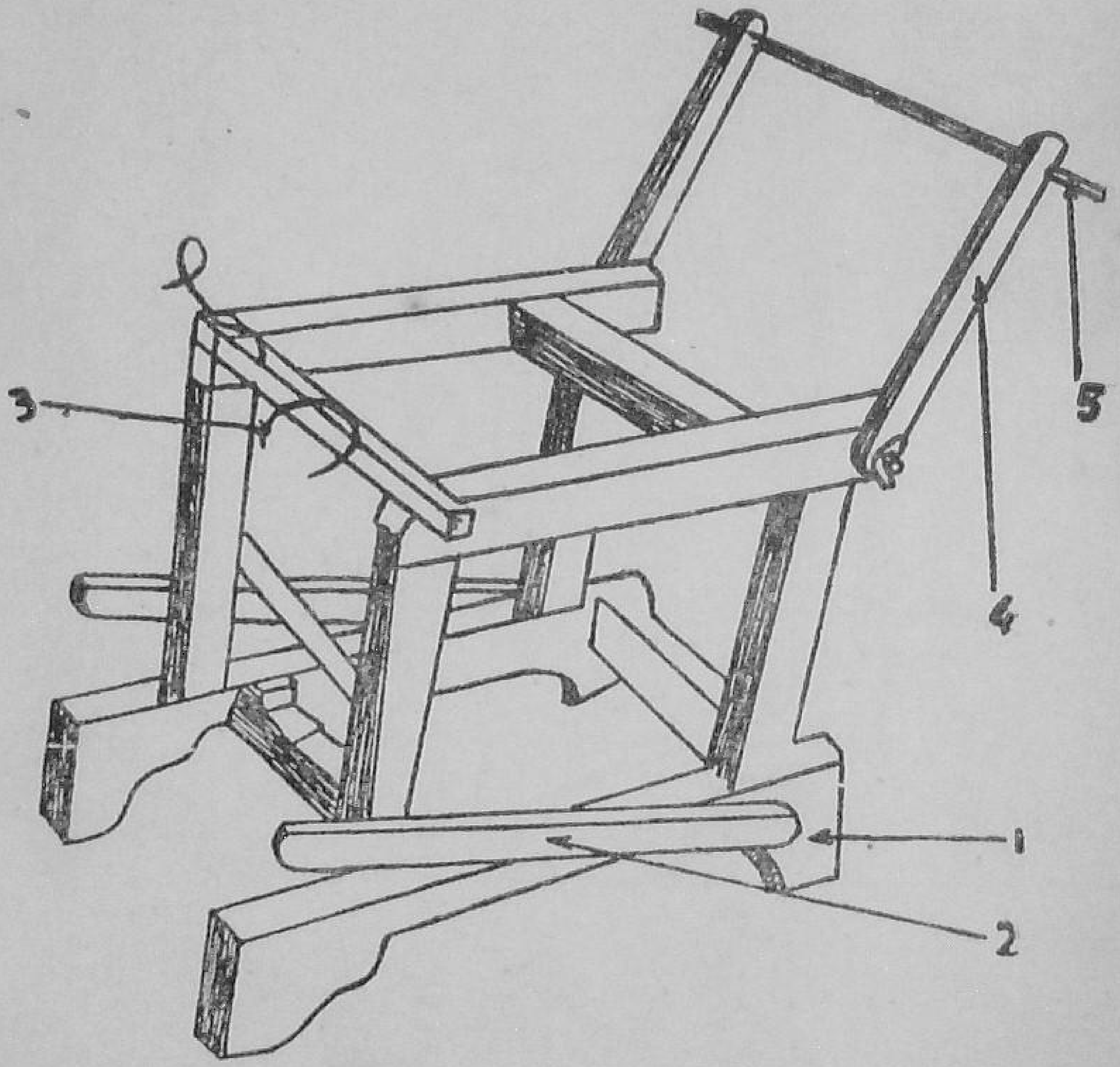


7. Gur & Khandsari Making

RASPADAR (HAND DRIVEN)

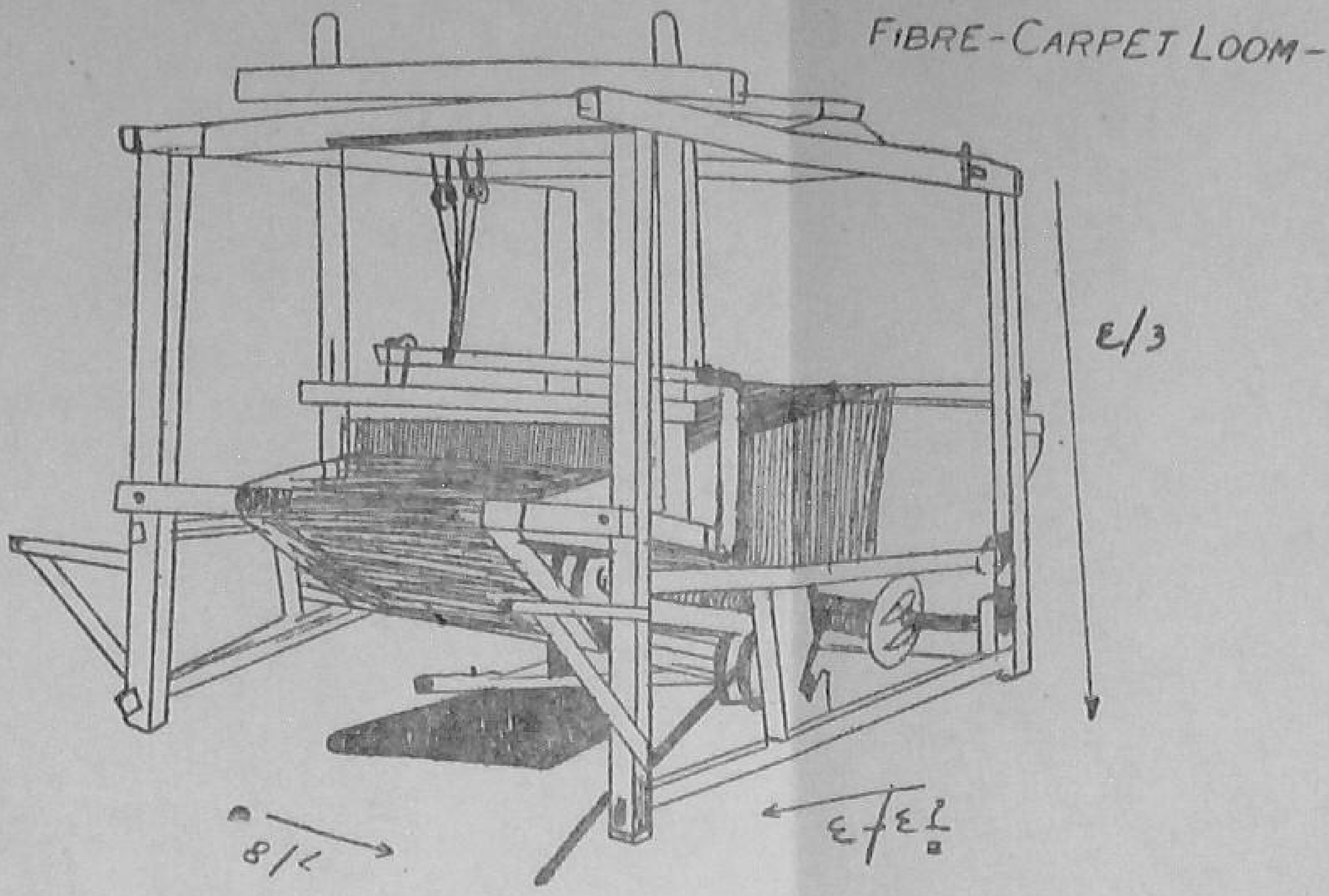


-CHARKHA-



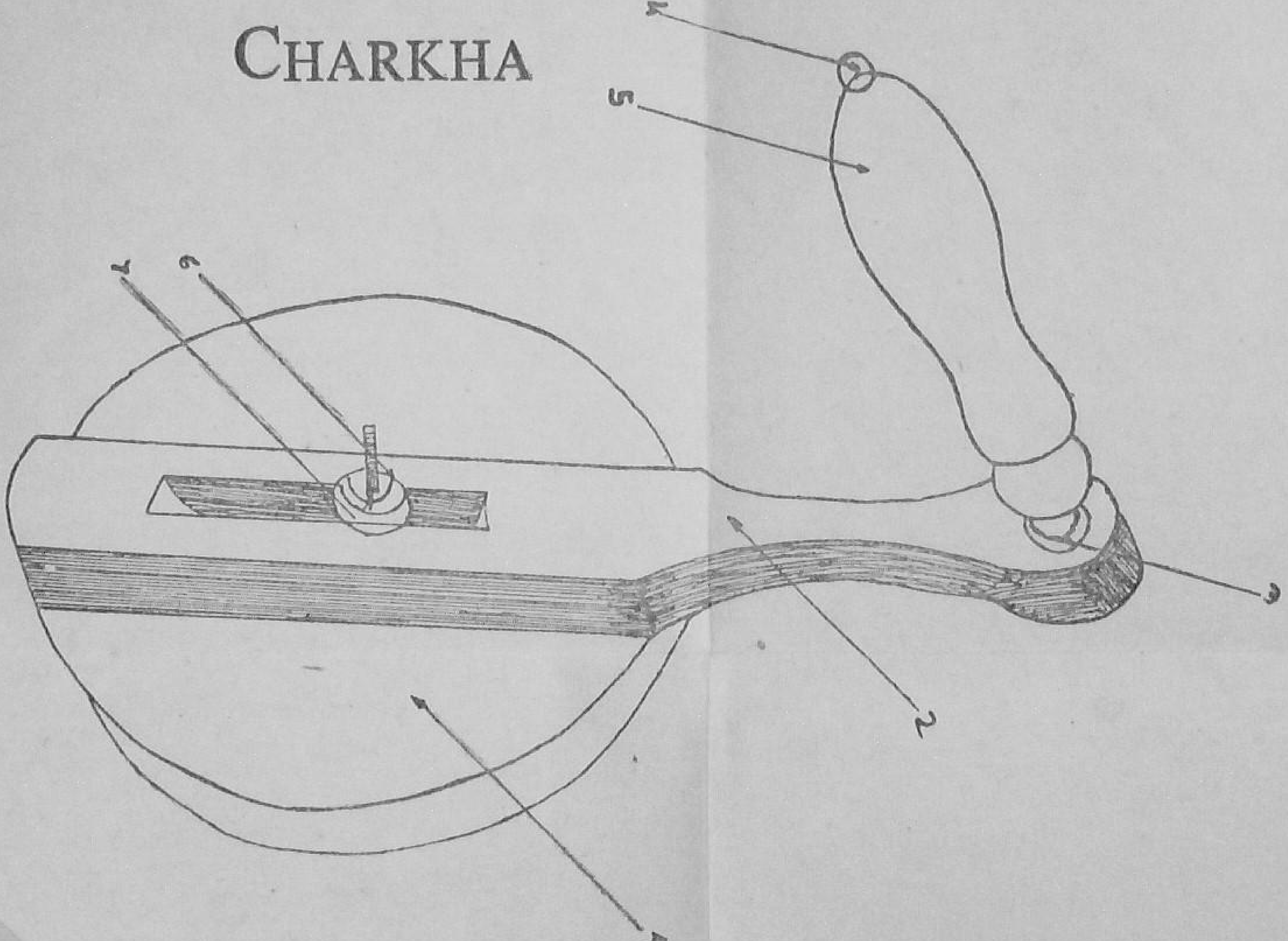
1. Khadi Amber
FRAME

1. Leg
2. Lift Bracket
3. Thread Hook (Sut Kadi)
4. Roying guide rod bracket
5. Roying guide rod



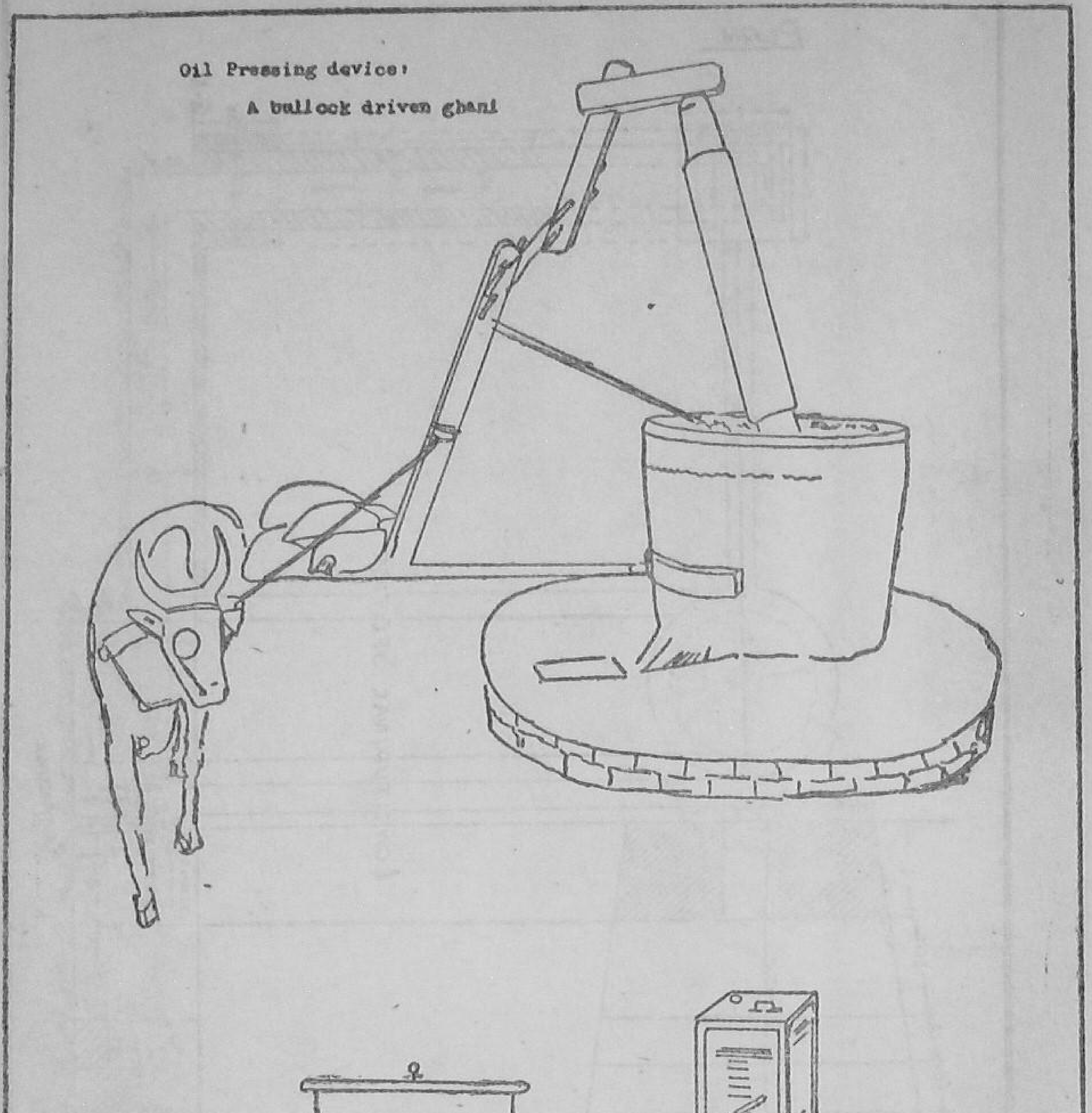
6 Fibre Industry

CHARKHA



1 Hand Spining.
HANDLE

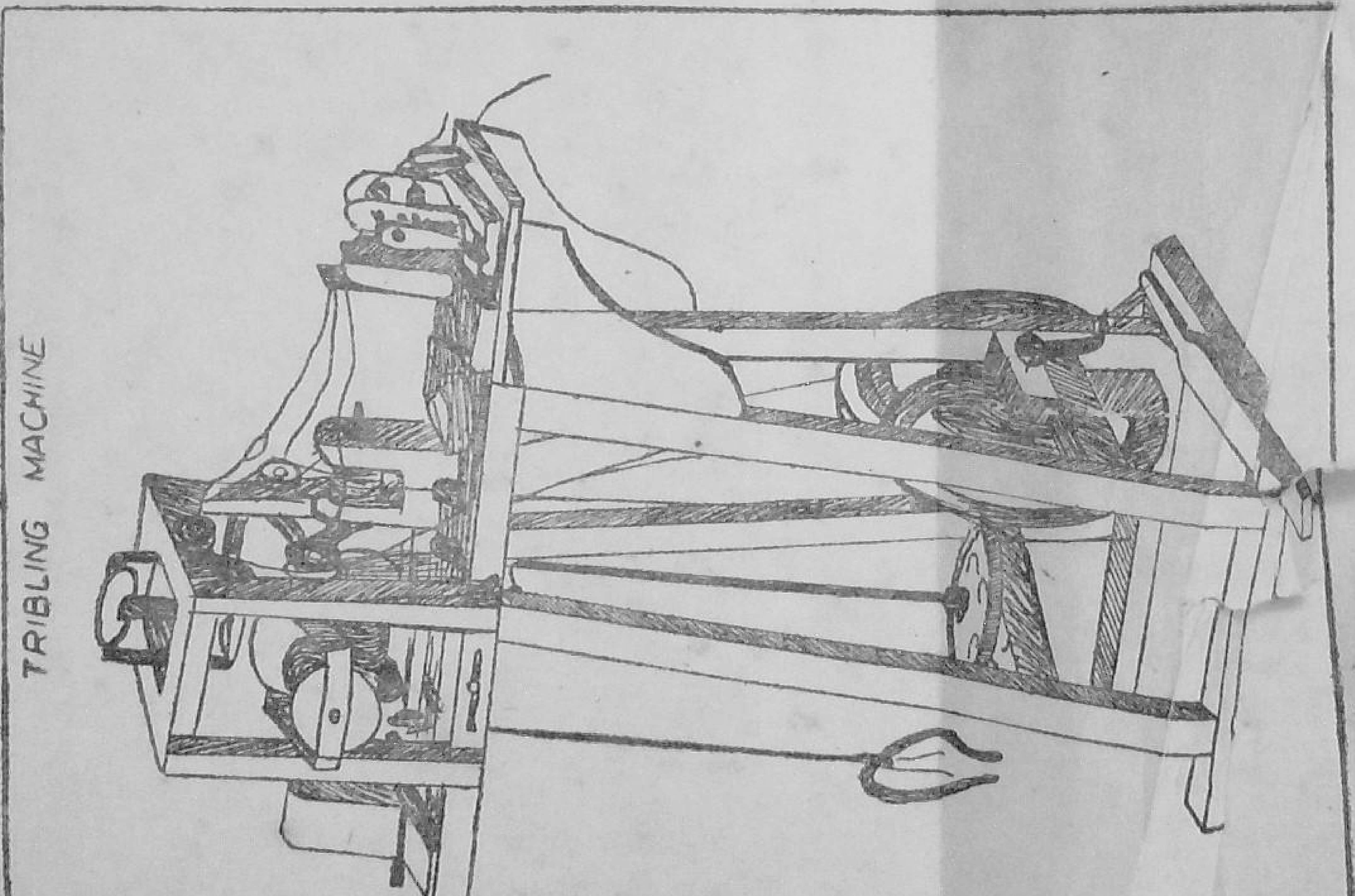
1. Main Pullhy
   7½″ Dia in Charkha and 8″ dia in Belni
2. Handle made of sisam Wood
3. Washer
4. Bolt
5. Handle grip
7. Fly Nut
6. Washer



10. Vi lage Chan

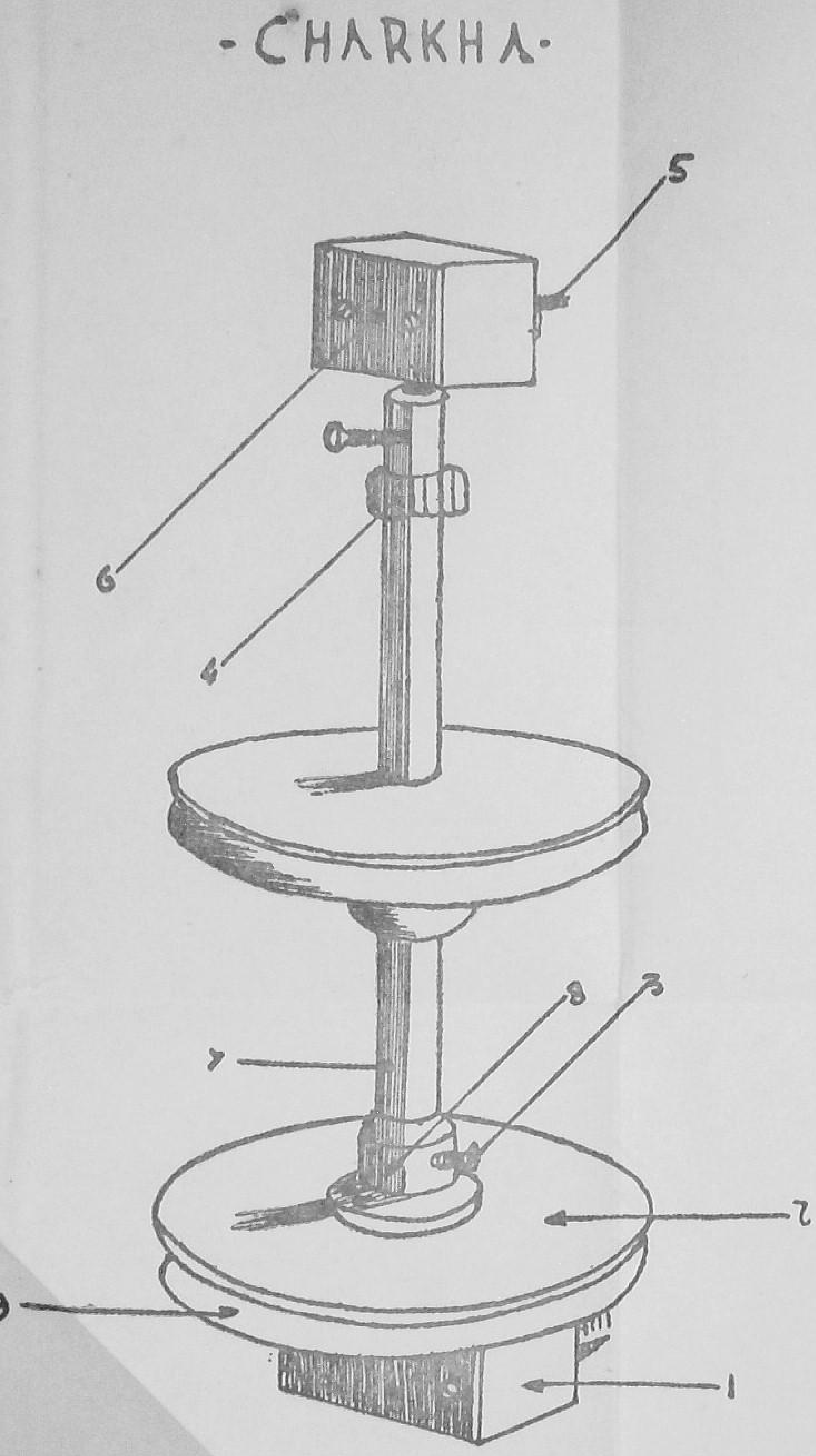
Ambar

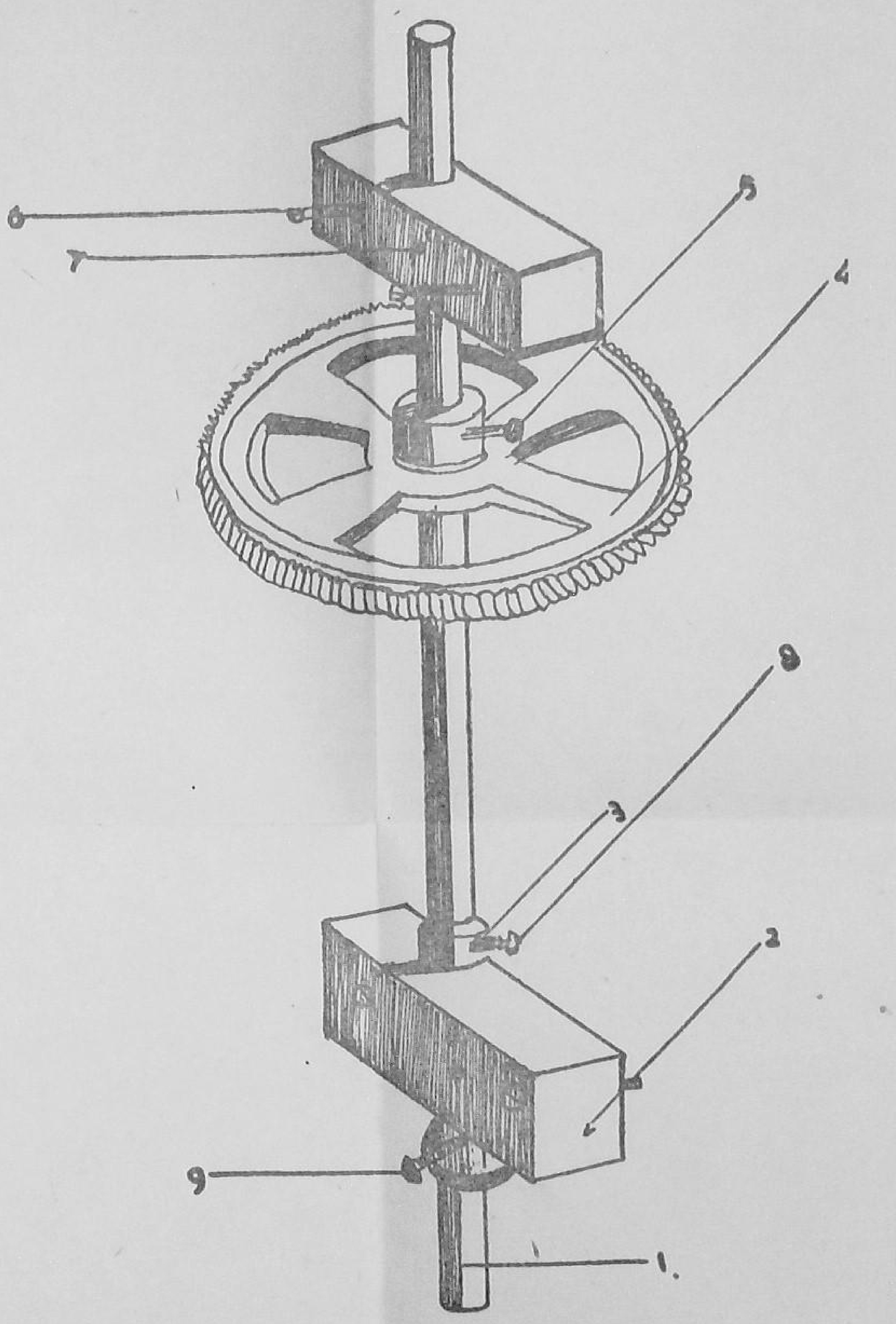
DRAWING



6 Fibre Iudustry

CHARKHA





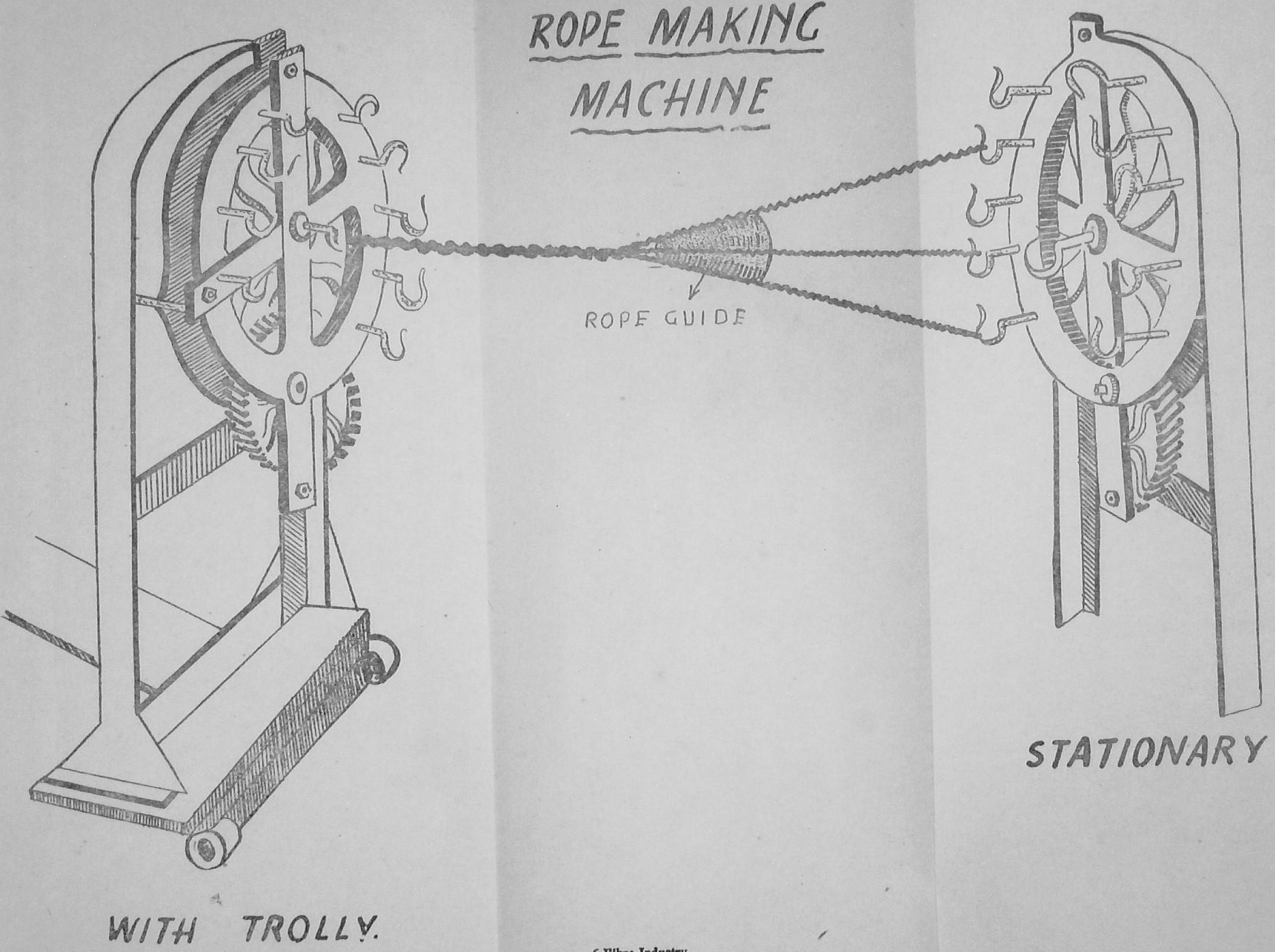
1 Khadi Charkha

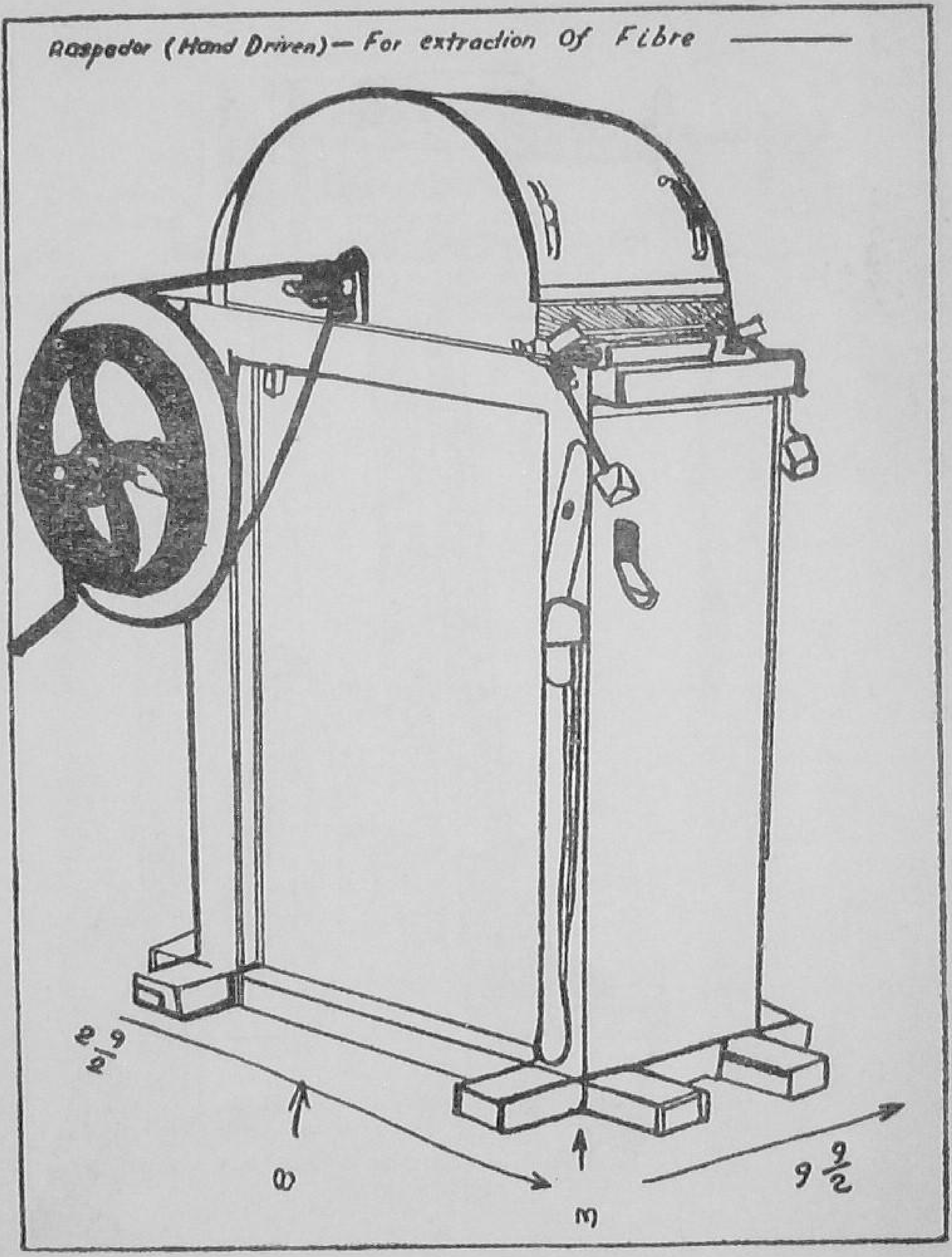
MAIN WHEEL

1. Shaft for main Pulley
2. Main Pulley shaft wooden piece
3. Collar
4. Gear Wheel 100 teeth
5. Machine screw to fit gear wheel on shaft
6. Wooden screw to fit the bearing on the frame
7. Place for oiling
8. Machine screw to tighten the collar
9. Machine screw to tighten the main U-groove pulley

SPEED WHEEL

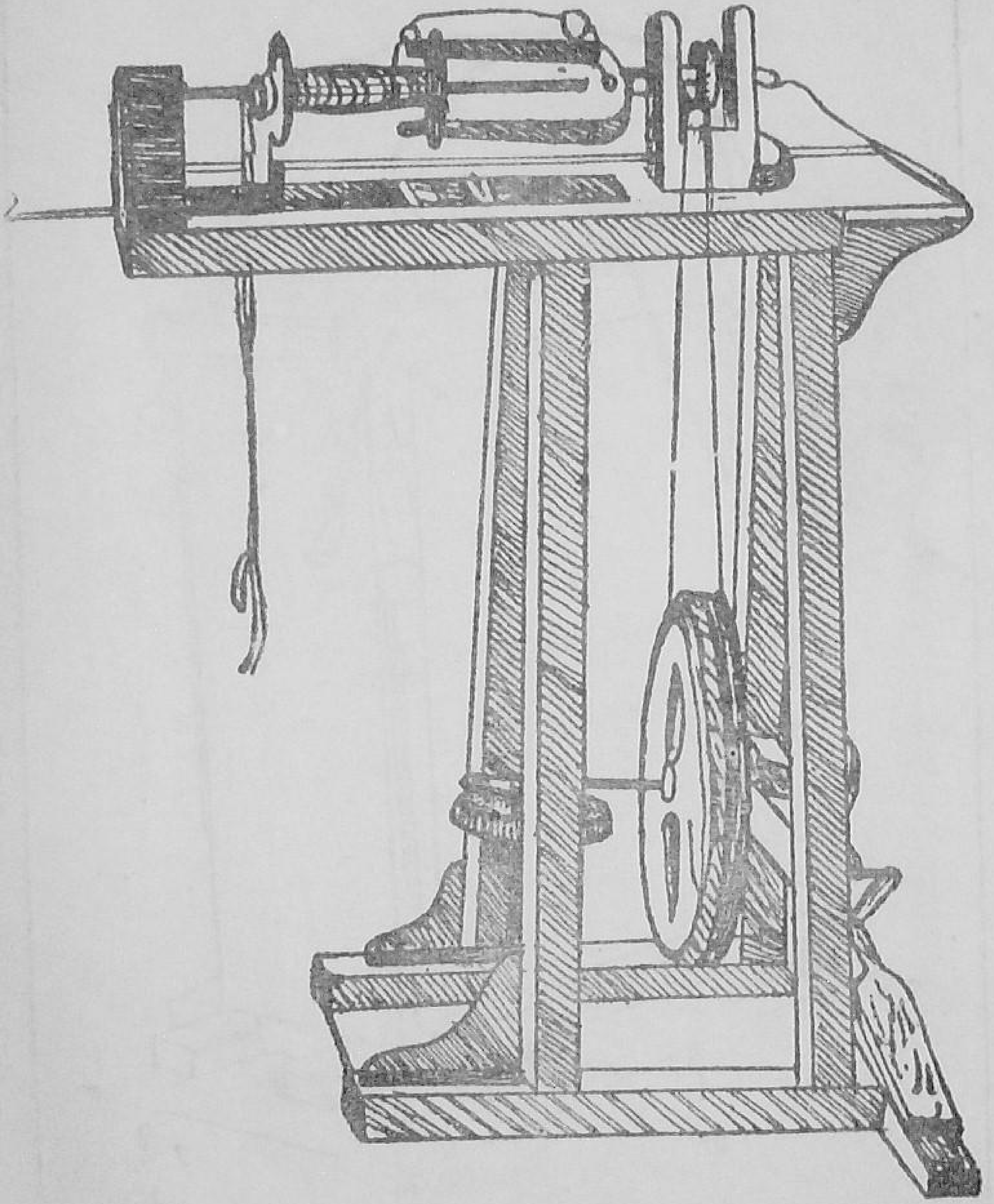
1. Bearing (made of sisam wood)
2. Speed pulley
3. Machine screw to fit flange on speed pulley
4. Gear wheel with 12 teeth
5. Wood screw to fit bearing piece with frame
6. Place for oiling bearing
7. Shaft for speed wheel
8. Flange
9. Speed pulley groove


ROPE MAKING
MACHINE
ROPE GUIDE
WITH TROLLY.
STATIONARY



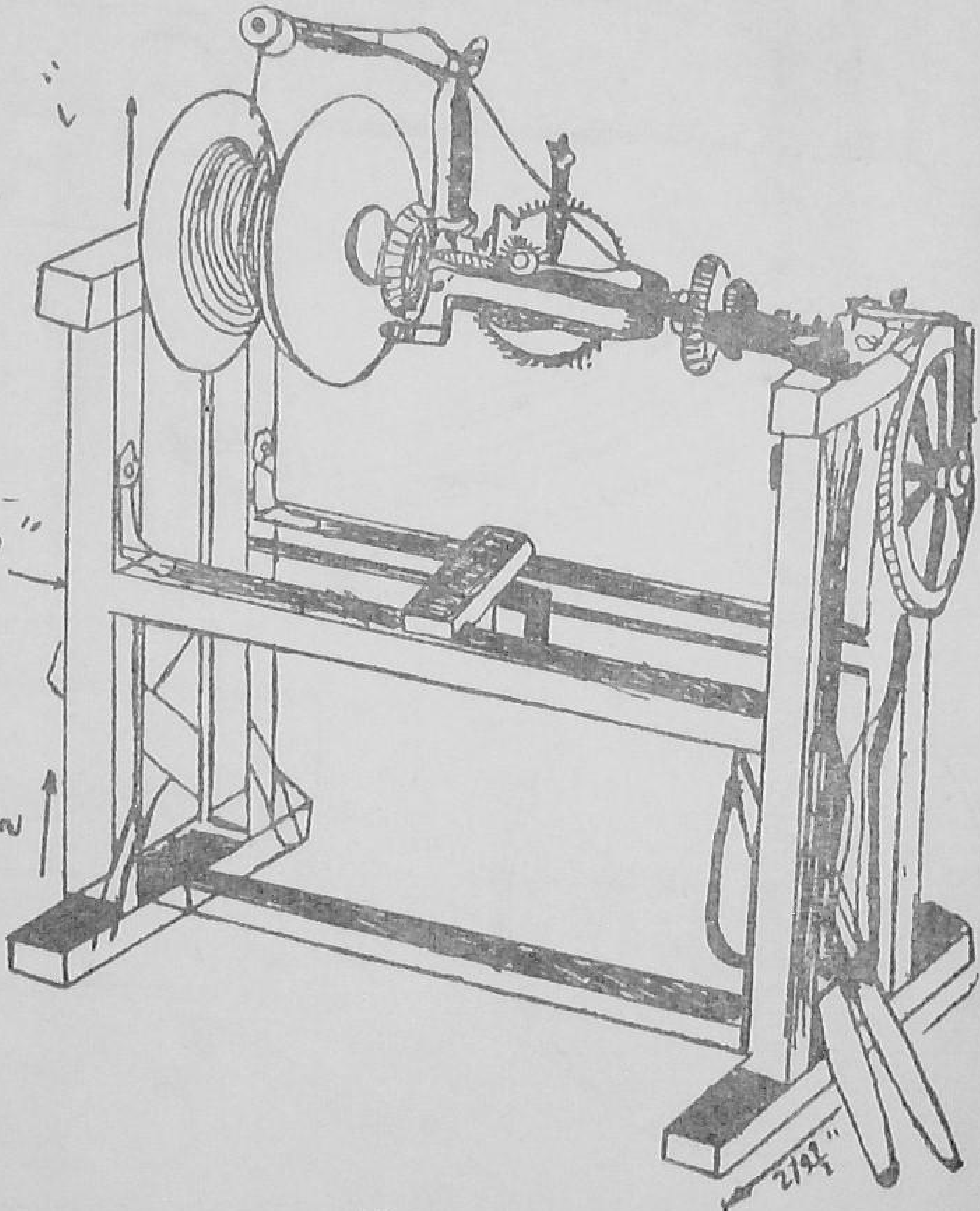
6 Fibre Industry

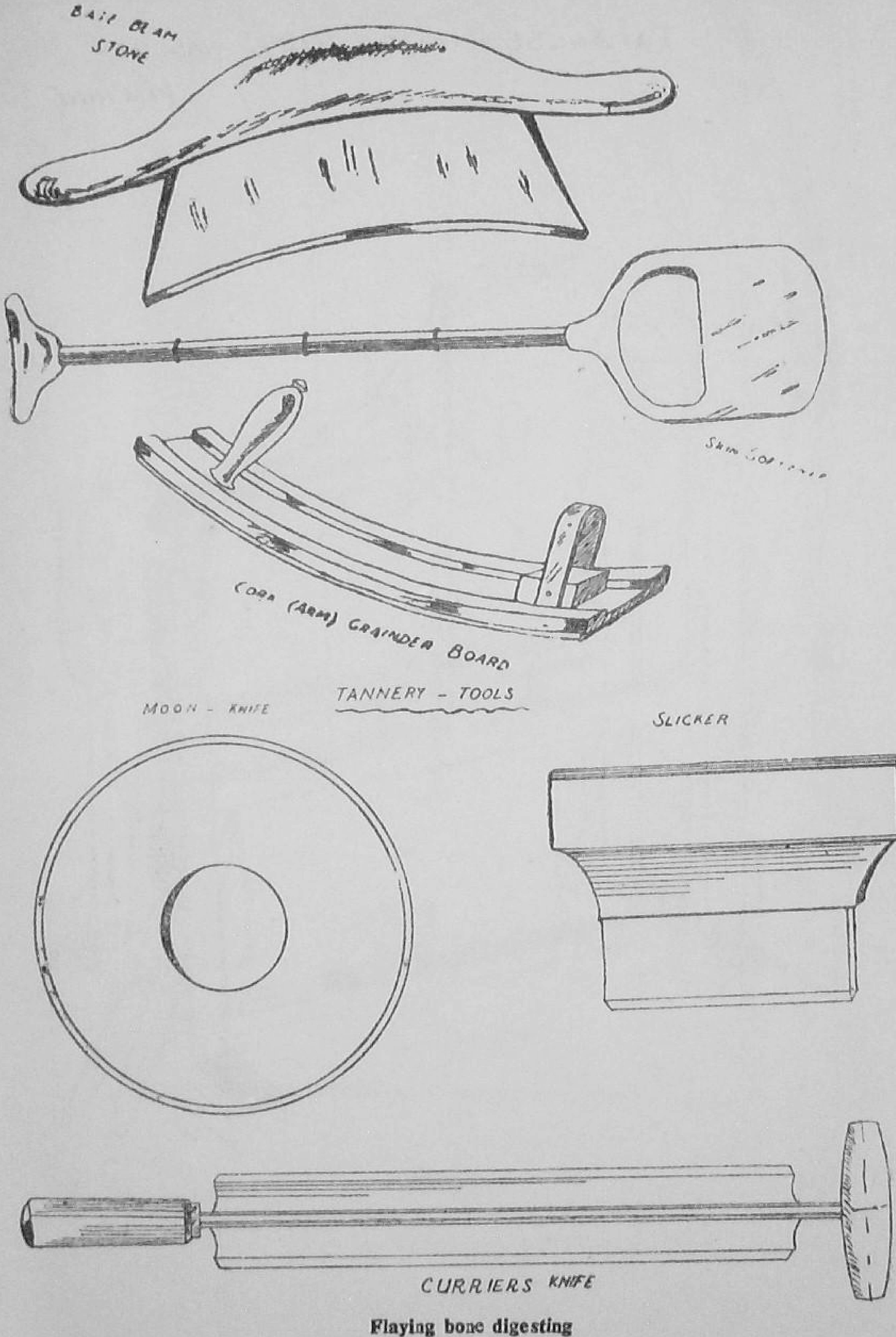
FIBRE SPINNING MACHINE



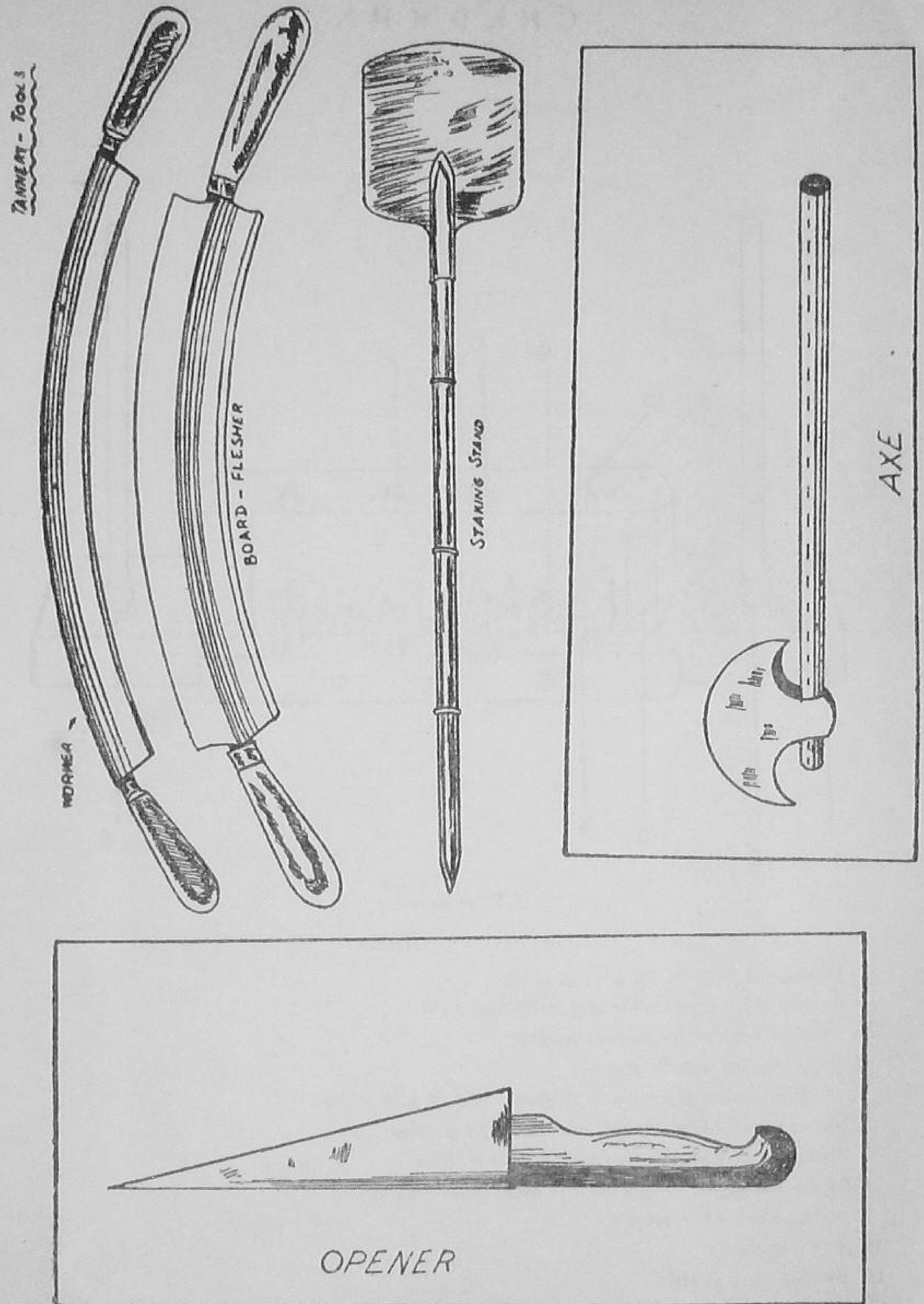
6 Fibre Industry

JAPANESE TWO PLY ROPE WASCING MACHINE



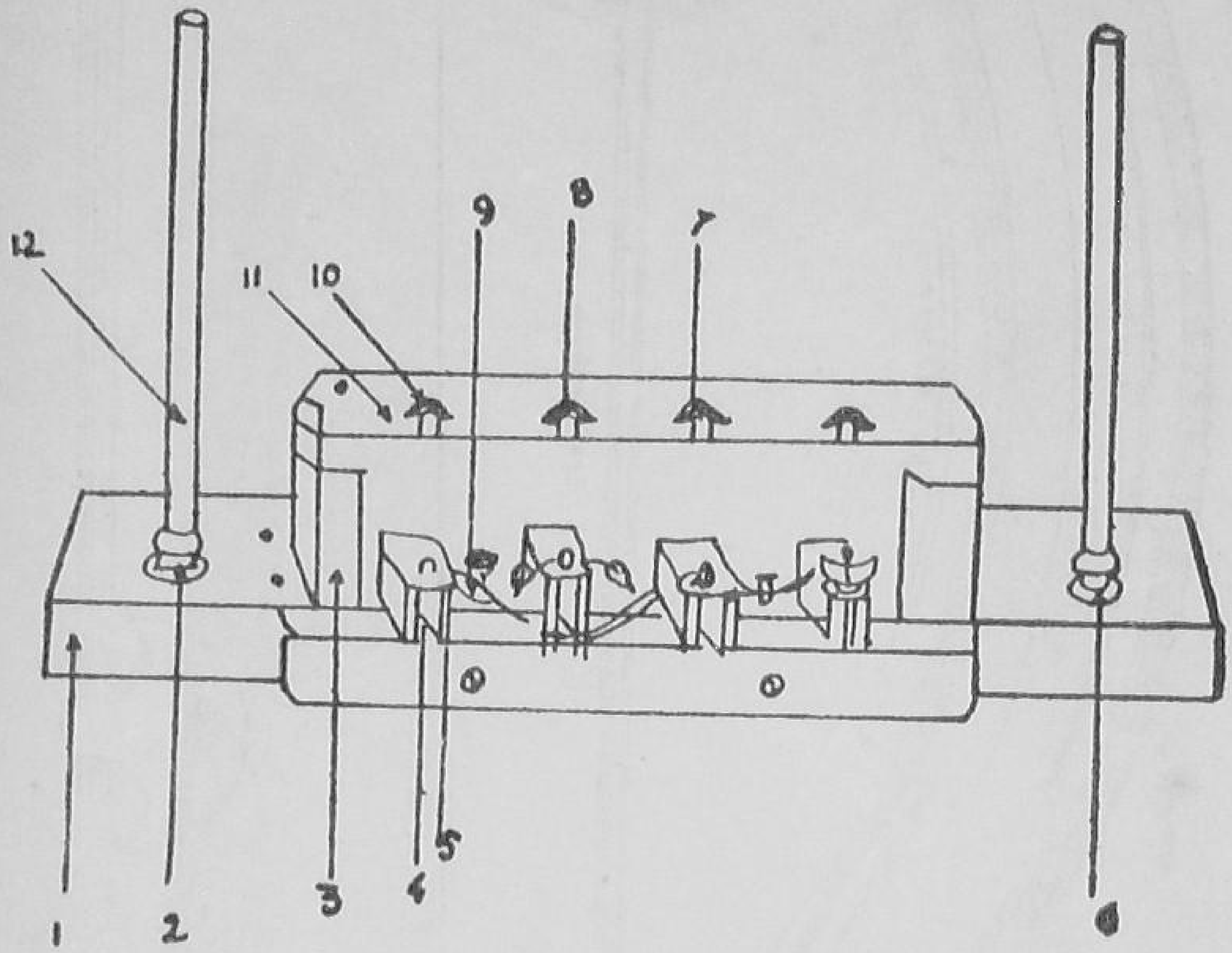


Flaying bone digesting



11 Flaying bone digesting

·CHARKHA·

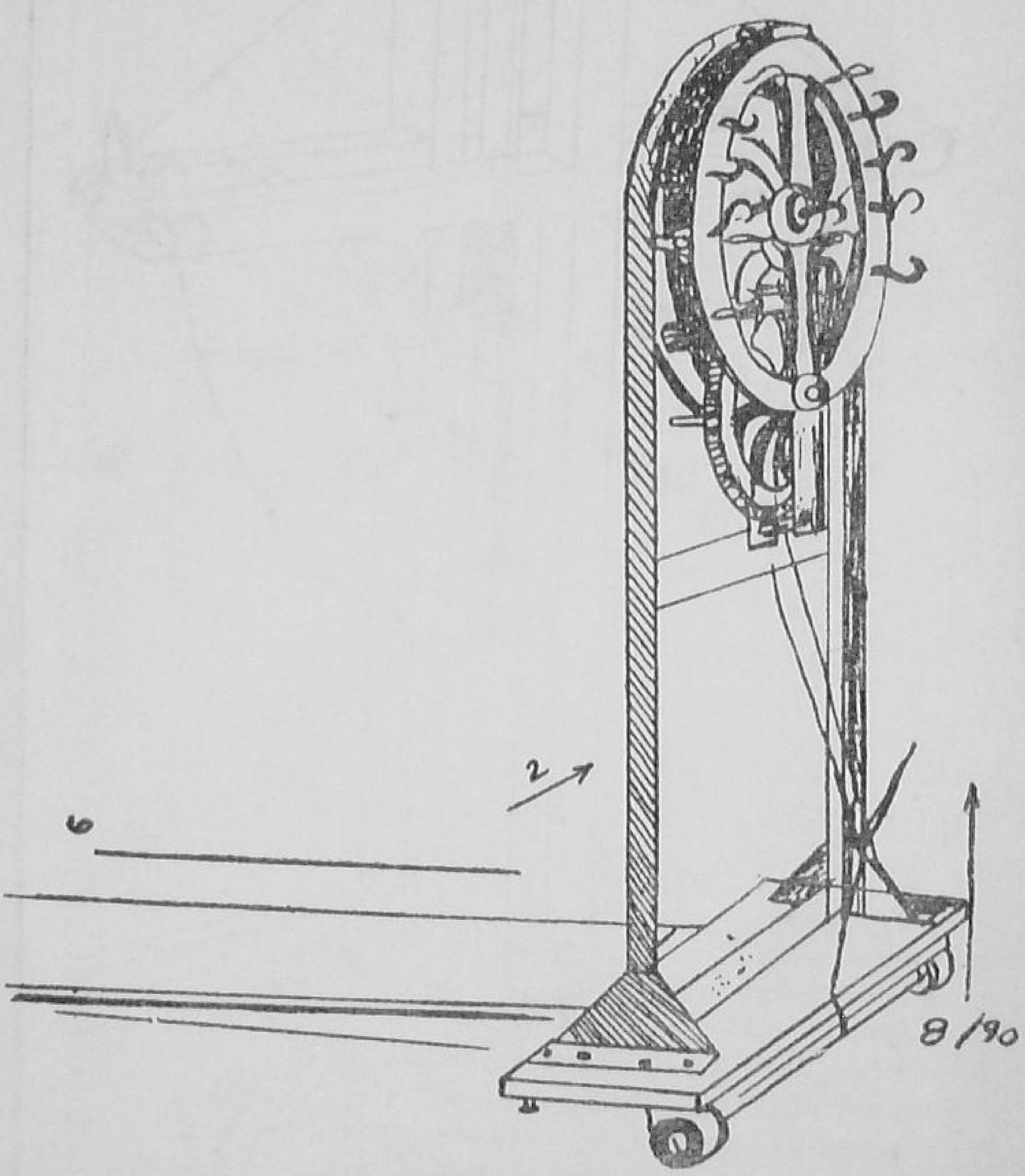


5 Fibre Industry

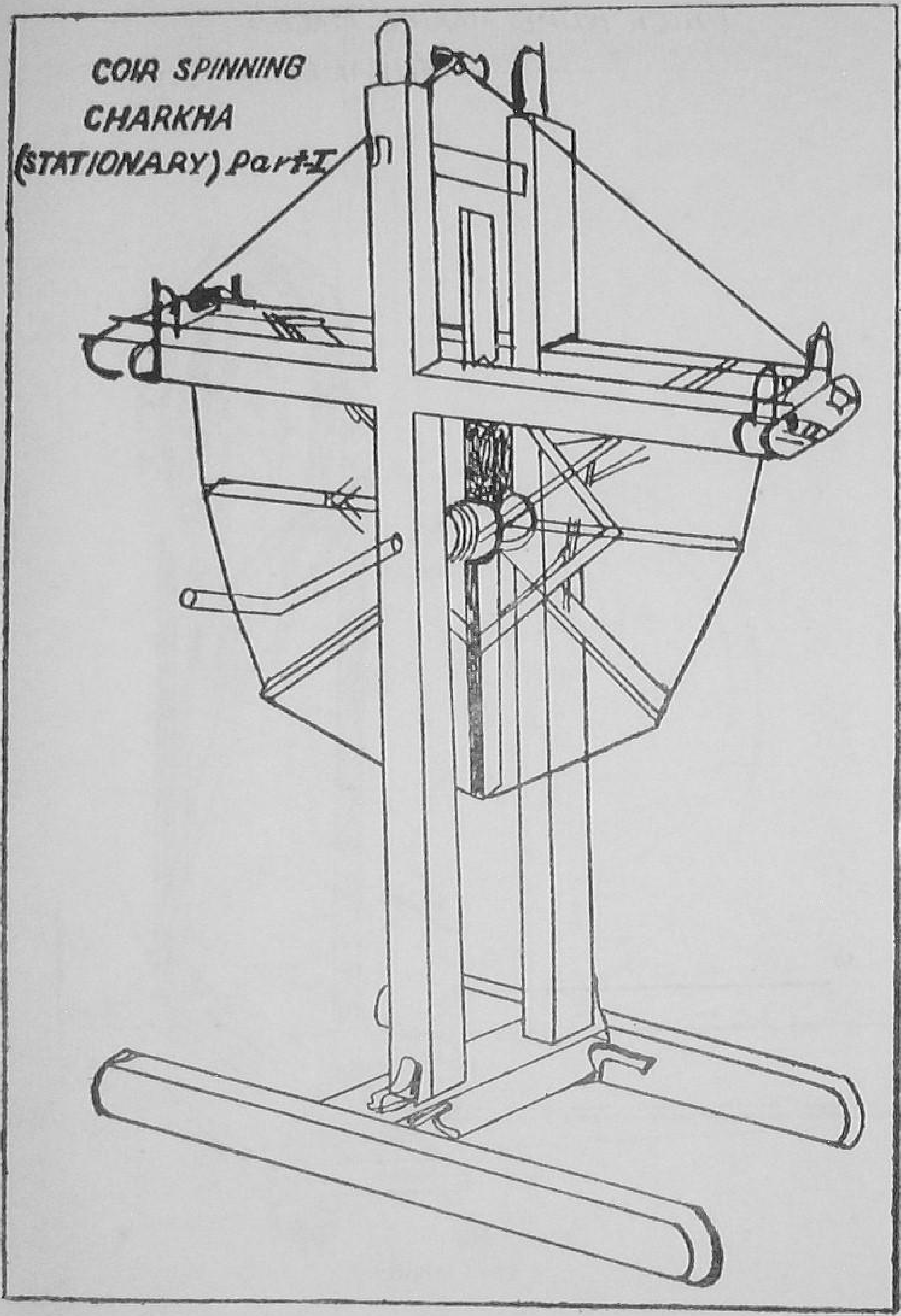
BOTTOM MODHIA

1. Horizontal Support for bottom modhia
2 Washer which supports the feeder (Bharni) Axle
3. Vertical support for bottom modhia
4. Supporter for spindle piece
5. Spindle bearing piece made of sisan wood (4 such pieces)
6 Nut to keep feeding (Bharni) Axle in proper position
7 Fly nut to keep spindle bearing ip proper position
8 String bearing for spindle fitted in upper supporting piece
9. String bearing for spindle
10. Bearing groove
11. Bearing strip (Patti)
12. (Bharni Axle) Feed Ax

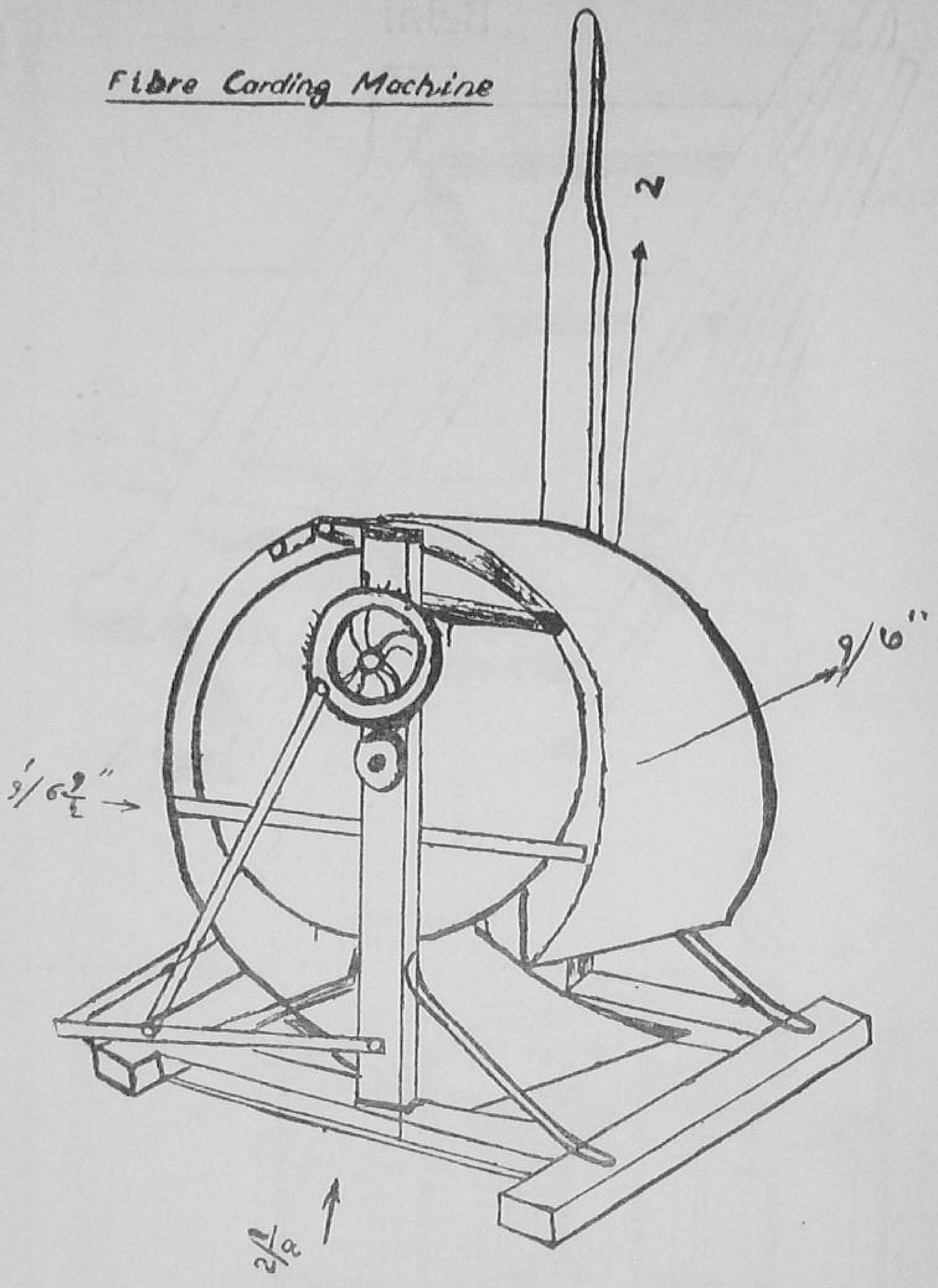
THICK ROPE MAKING MACHINE
MOVABLE - PART ,



6 Fibre Industry

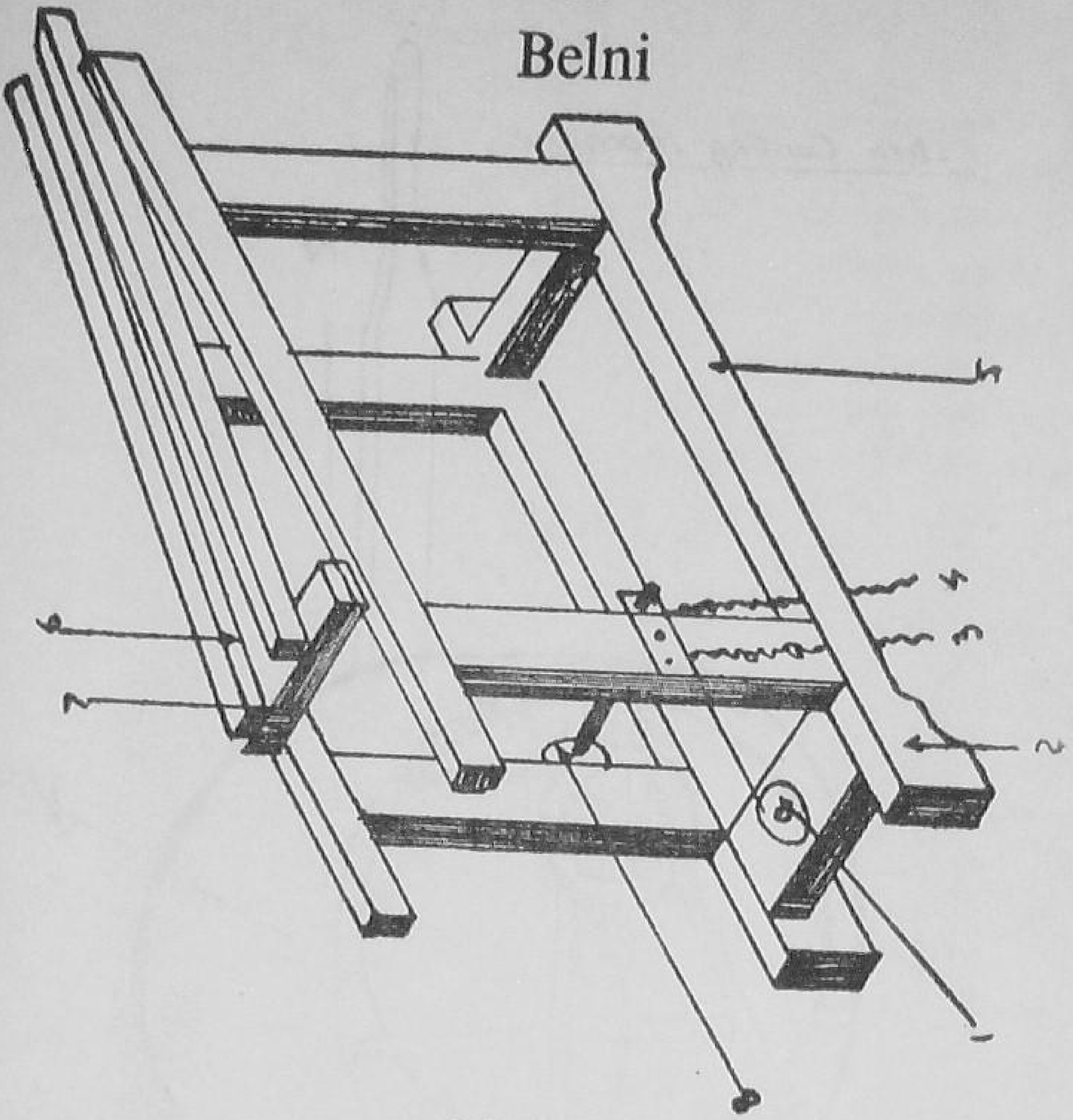


6 Fibre Industry



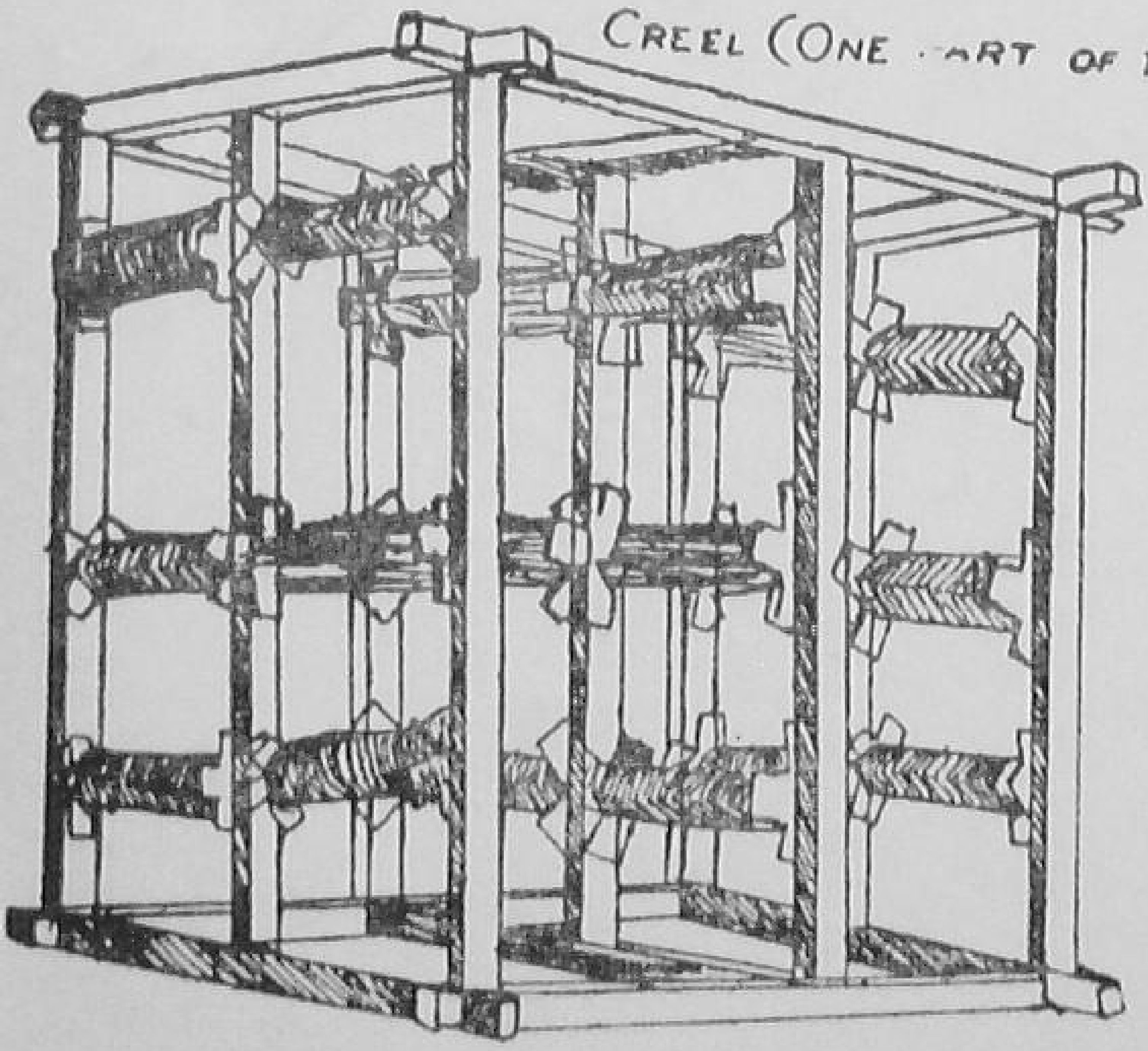
6 Fibre Industry

Belni



1 Khadi Amber

CREEL (ONE PART OF THE WARPING MILL)

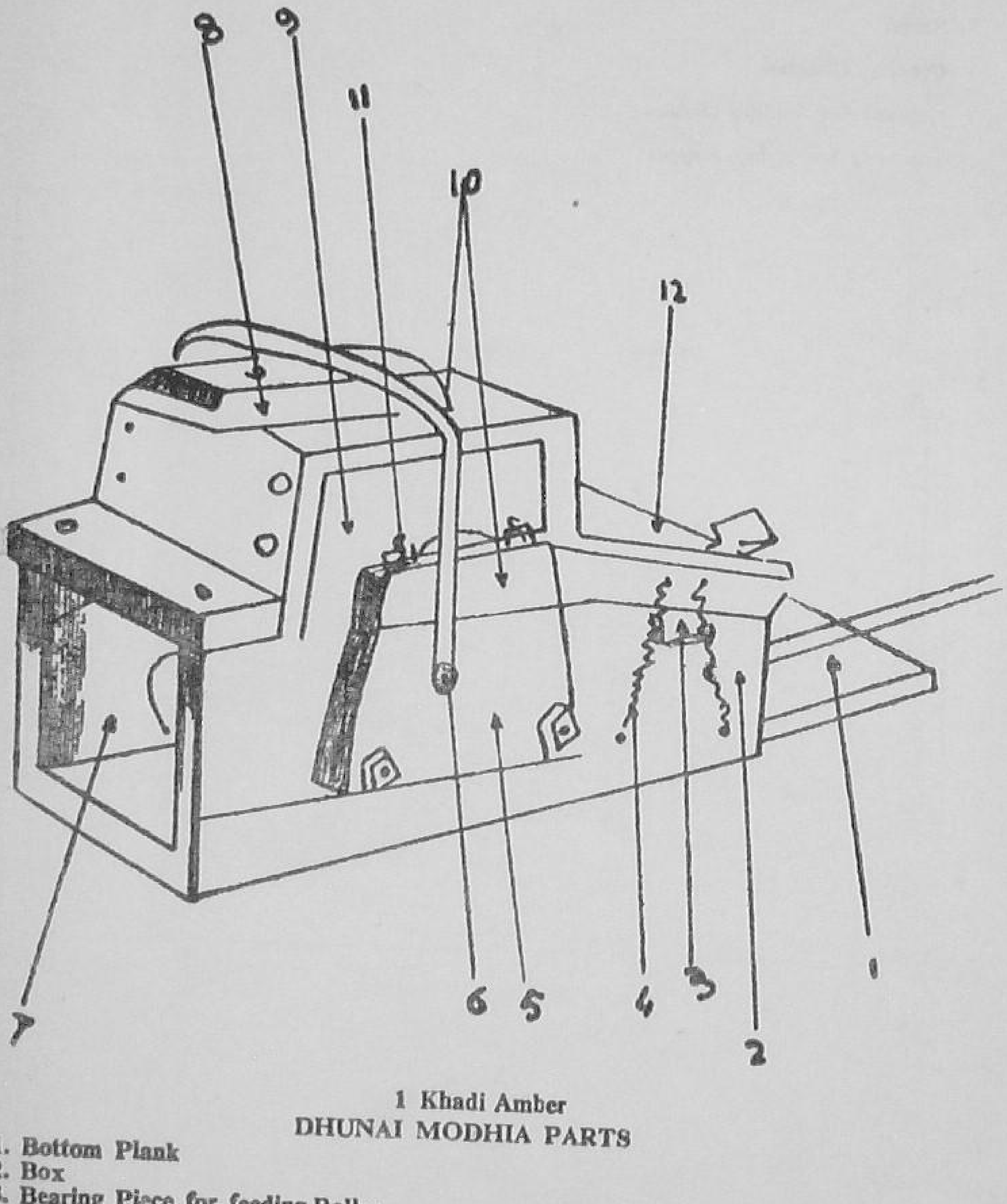


Fibre Industry

BELNI STAND

1. Supporting flange with ball in bottom
2. Leg
3. Iron Supporter
4. Iron Supporter
5. Stand
6. Feeding Channel
7. Support for feeding channe
8. Iron rod for string Support

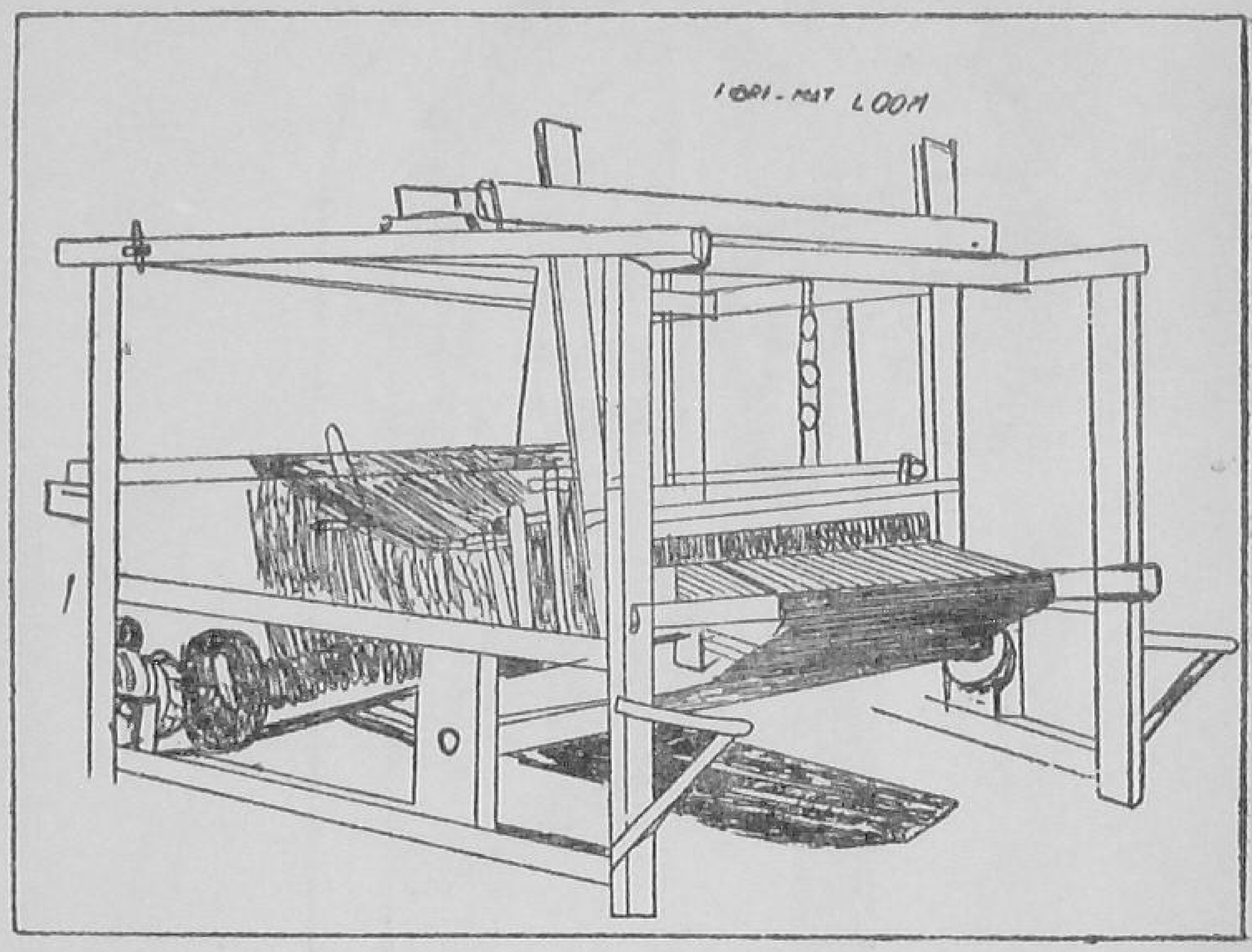
- DHUNAI MODHIA -



1 Khadi Amber

DHUNAI MODHIA PARTS

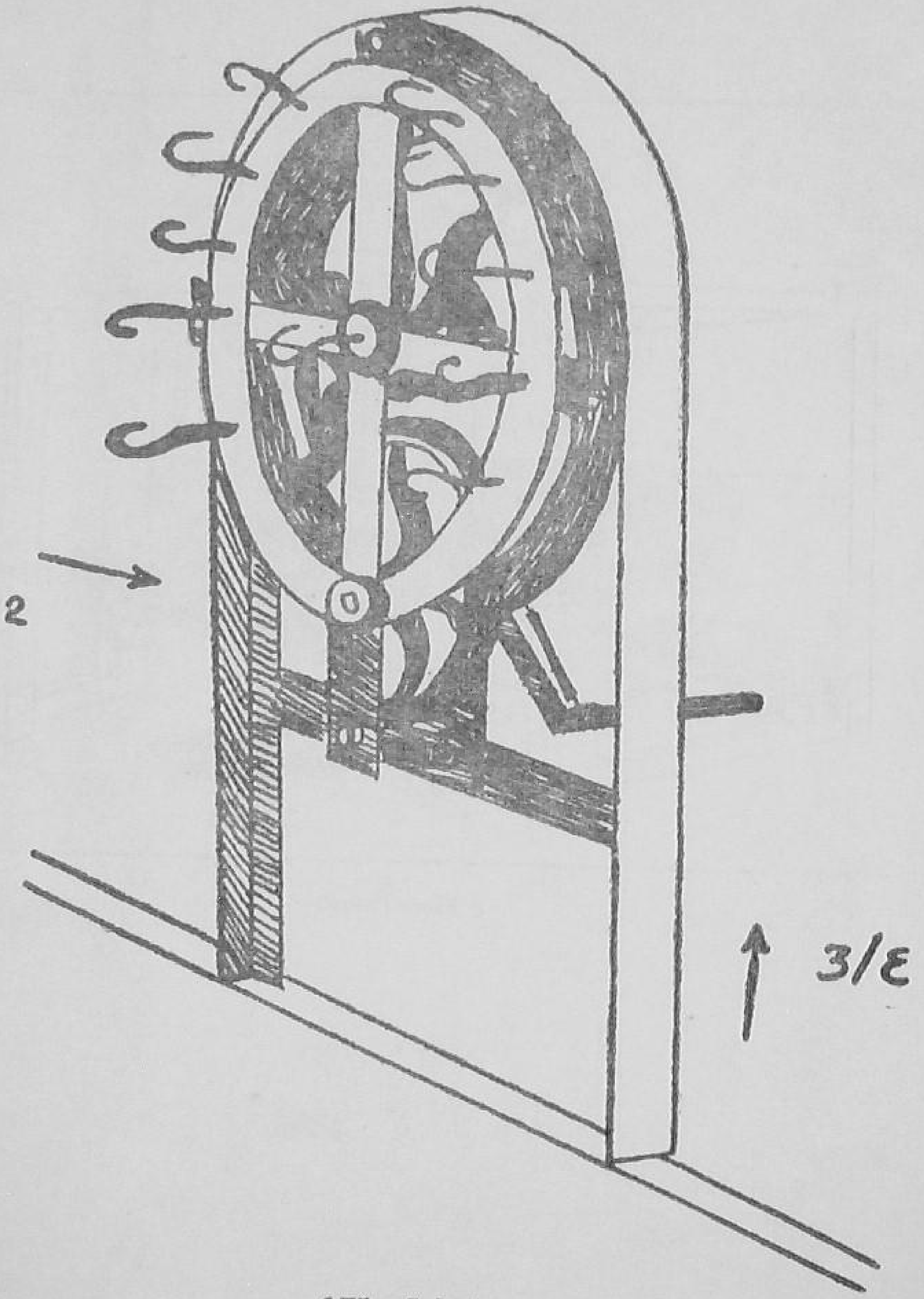
1. Bottom Plank
2. Box
3. Bearing Piece for feeding Roller
4. Box
5. Iron Ring
6. Mouth for Pole Peti
7. Fastner
8. Box
9. Pedestal
10. Nut for tightning pedestal
11. Iron plate before feeding roller



6 Fibre Industry

THICK ROPE MAKING MACHINE

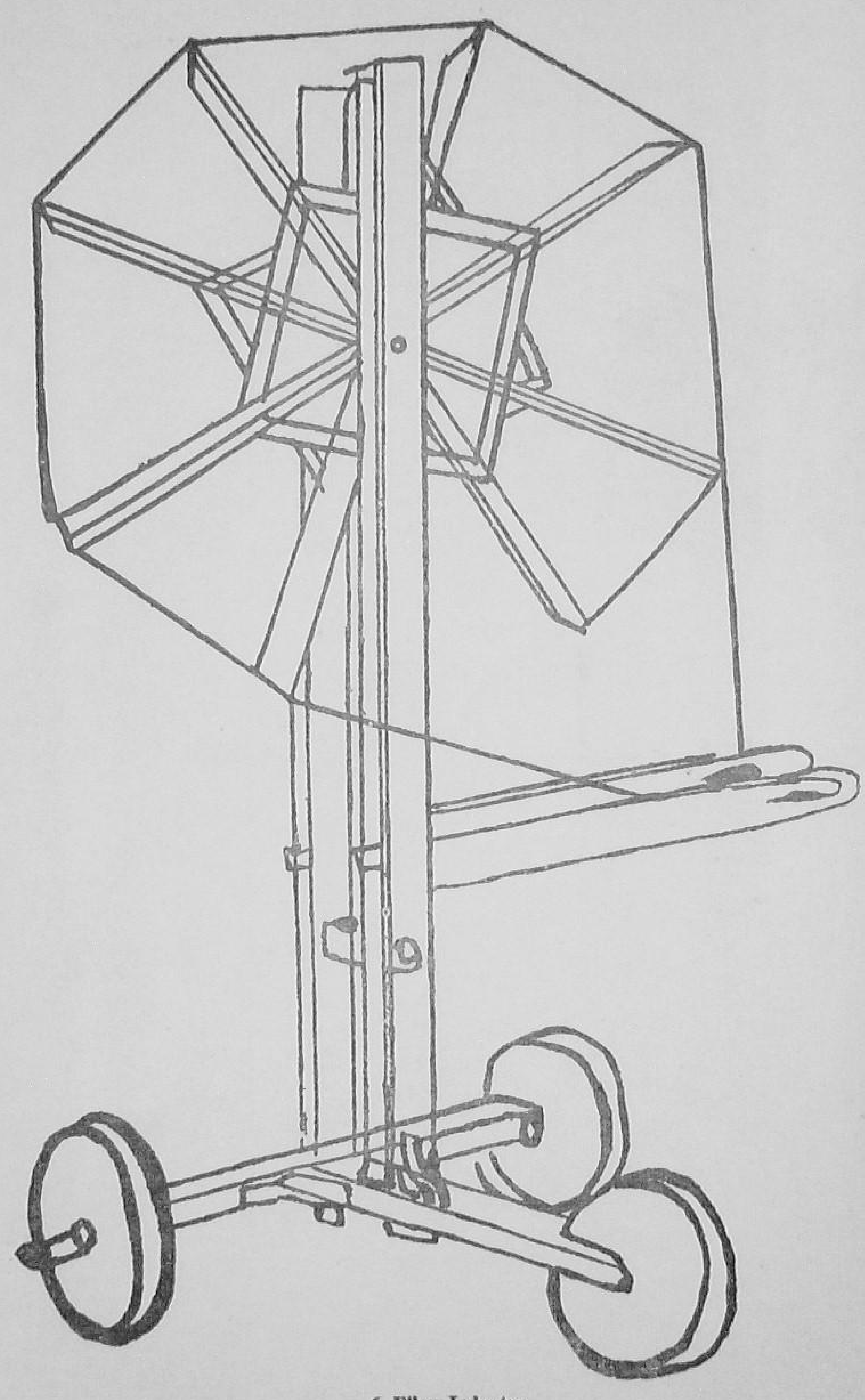
STATIONARY-
PART II



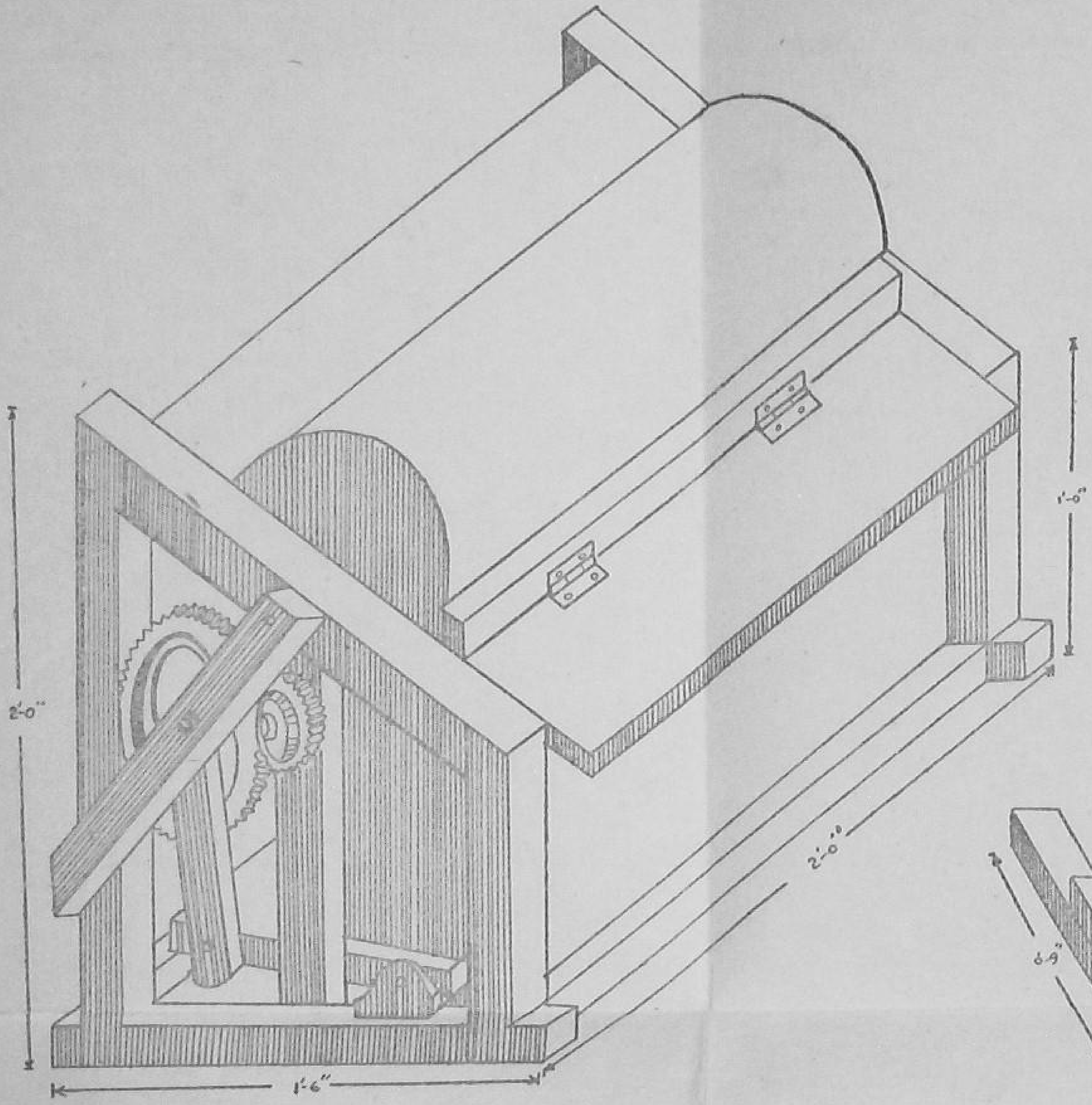
6 Fibre Industry

Coir Spinning Charkha

—Mov Able—
Part !!

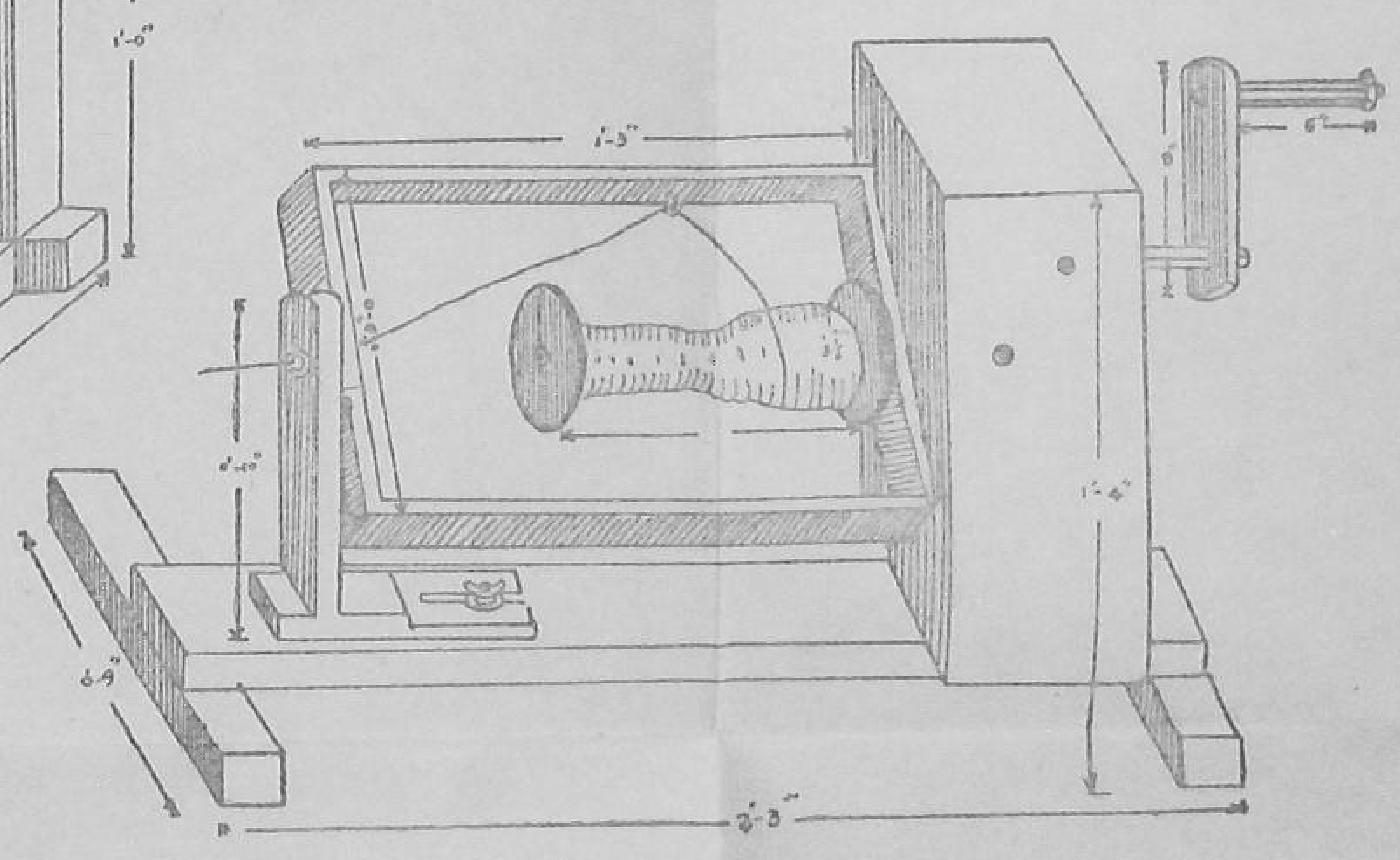


KHADI & VILLAGE INDUSTRIES COMMISSION DHARWAR
DRAWING NO:-
SHEET NO:-



FIBRE CARDING MACHINE

SCALE :- 1'=3"



FIBRE SPINNING CHARKHA

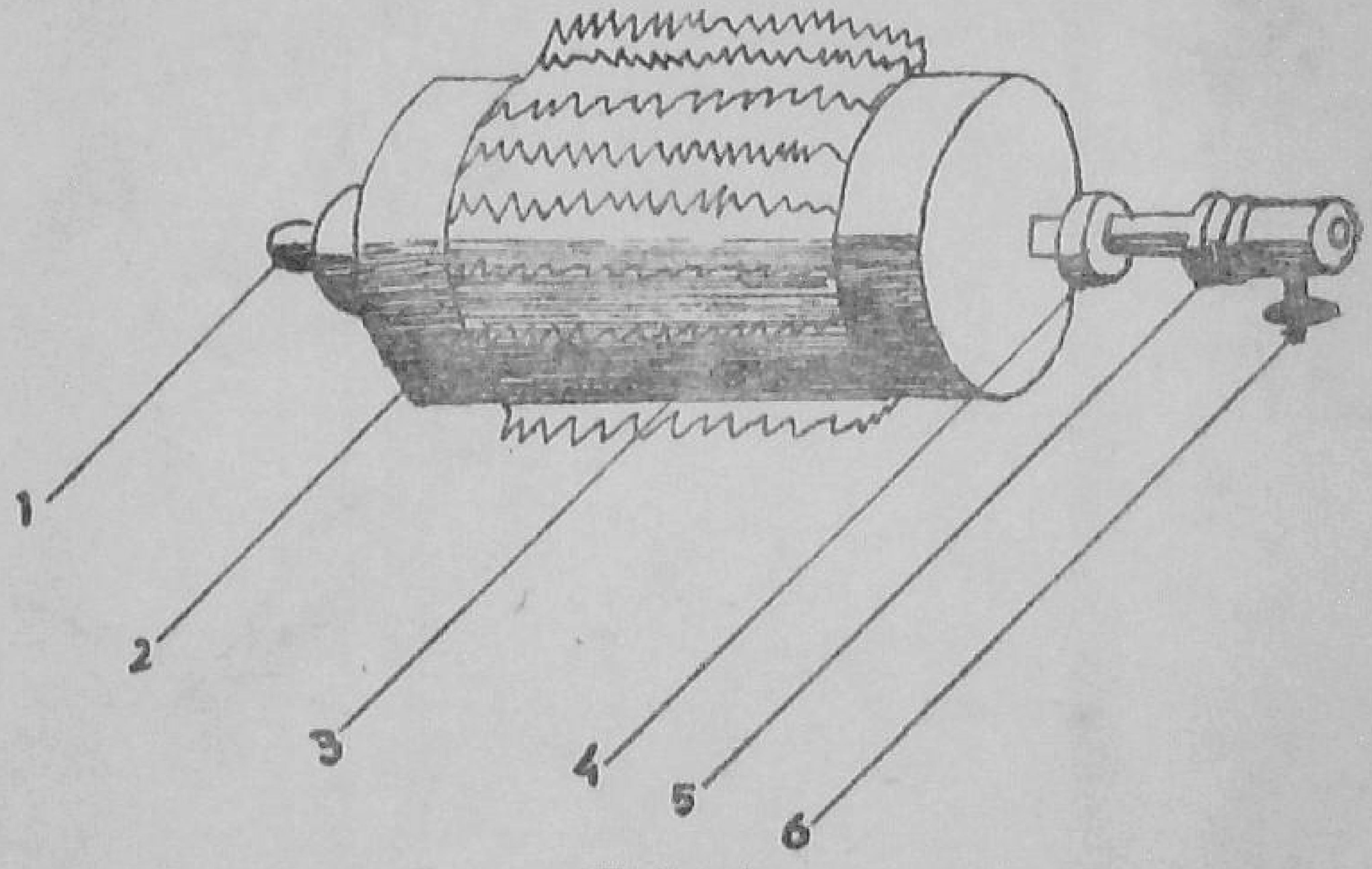
SCALE :- 1'=3"

ORGANISER FOR BEE-KEEPING AND FIBRE
KHADI AND VILLAGE INDUSTRIES COMMISSION
DHARWAR

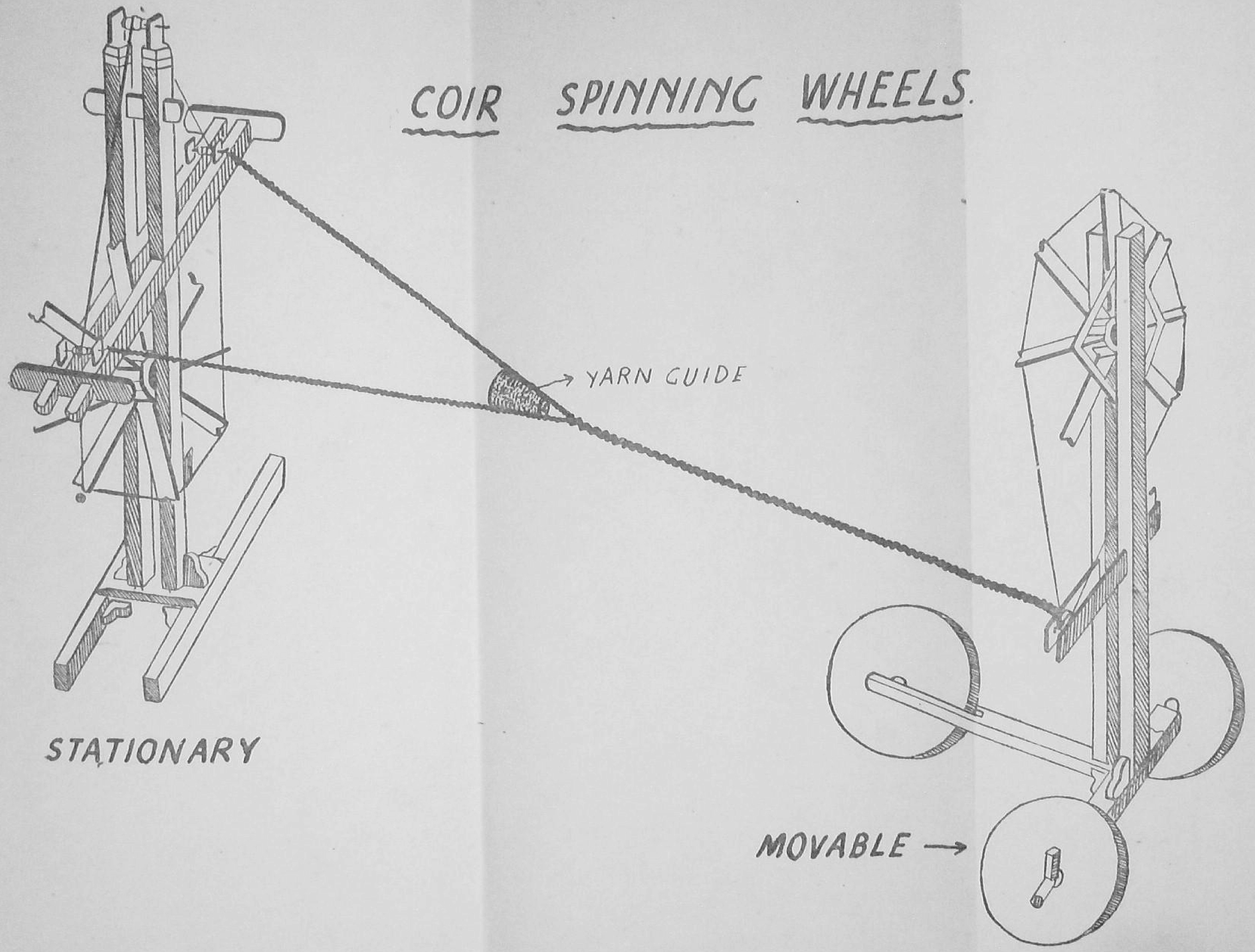
DRAWN BY :- P M Ashtapale
TRACED BY :- H. B. Hiremath

DHUNAI· MODHIA·

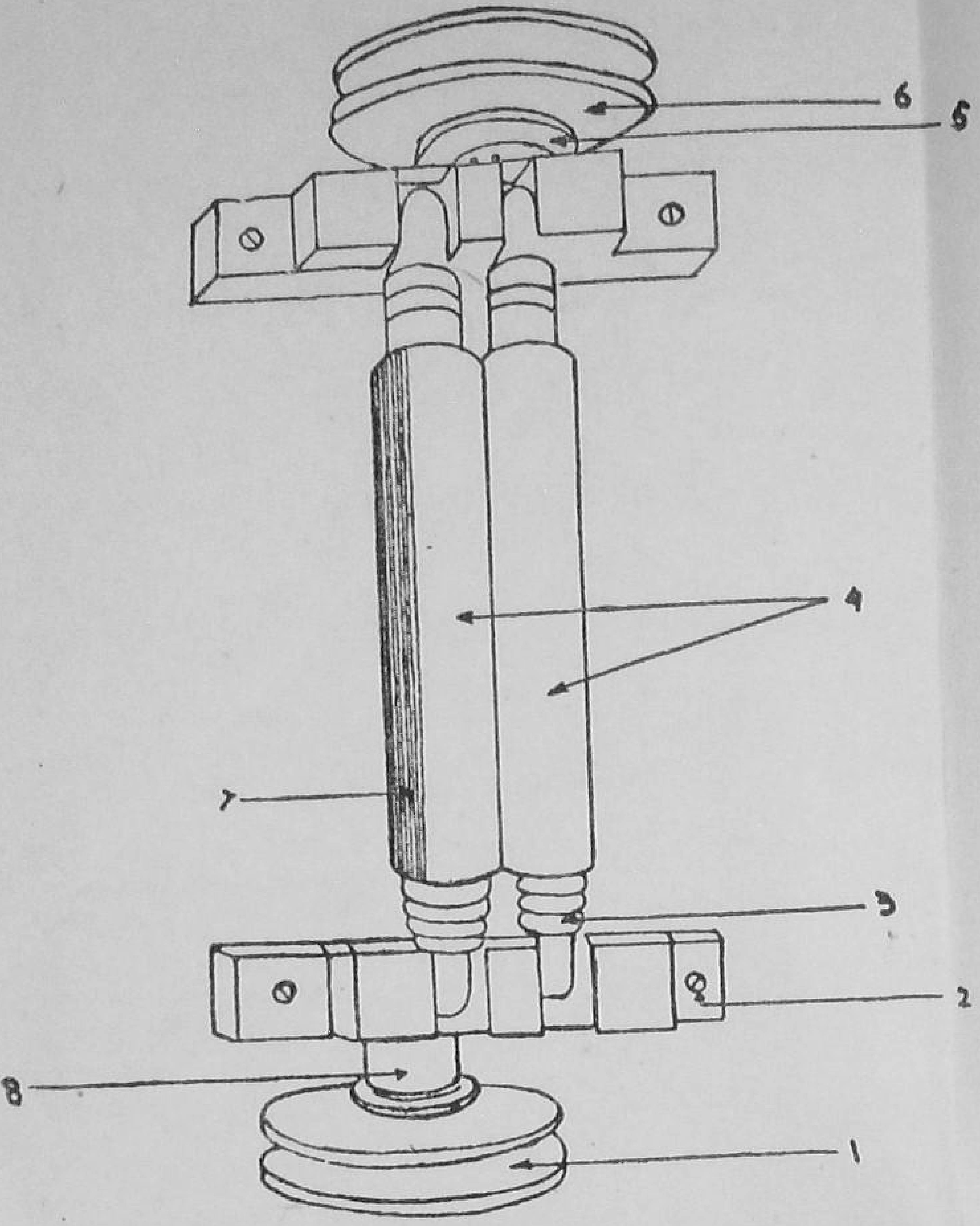
1. Saft
2. Wooden Dram
3. Comb
4. Ball B earixg
5. Pulley
6. Machine Screw



Khadi Amber

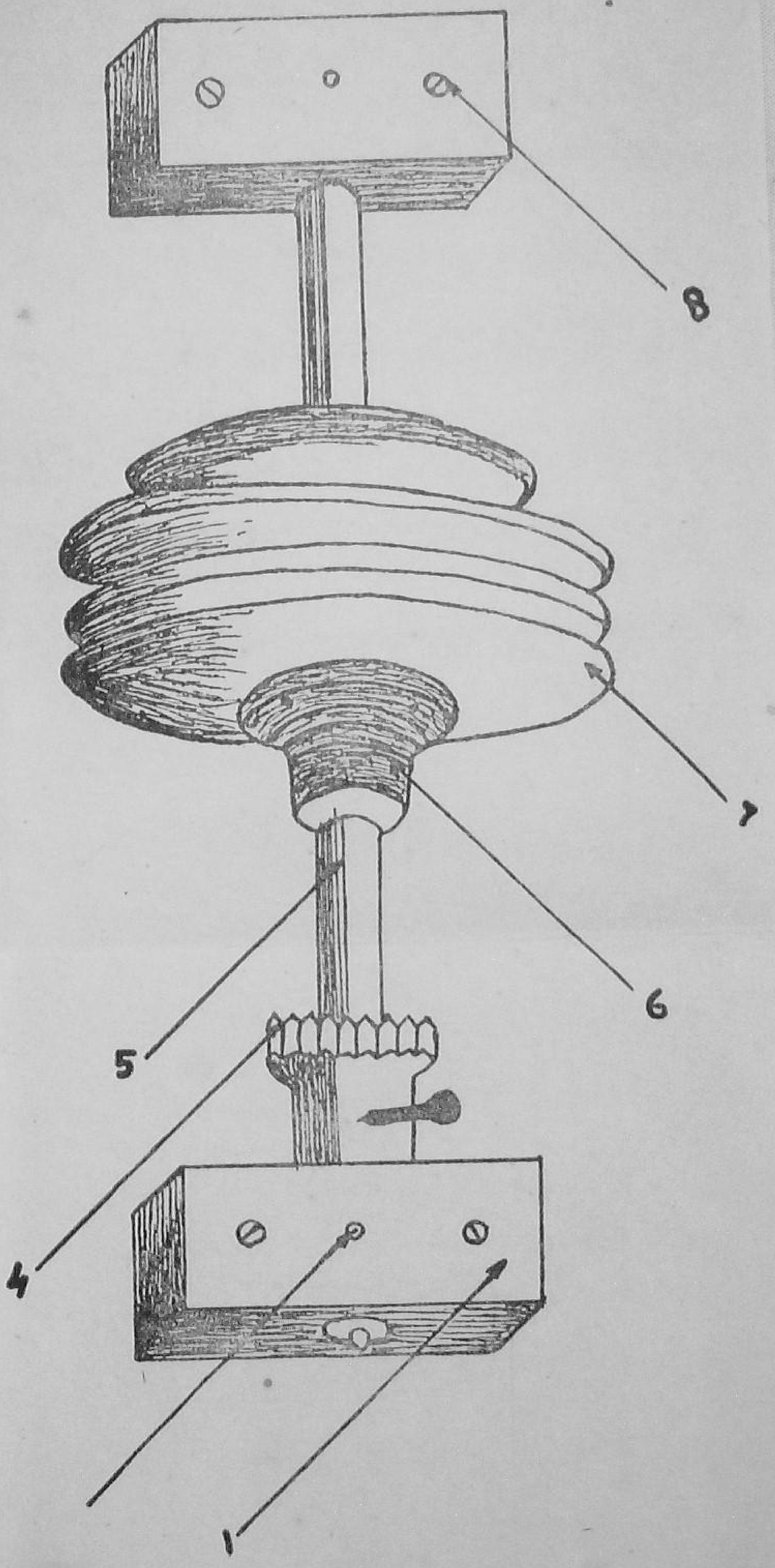

COIR SPINNING WHEELS.
YARN GUIDE
STATIONARY
MOVABLE

-BELNI-



1 Khadi Amber

-BELNI-

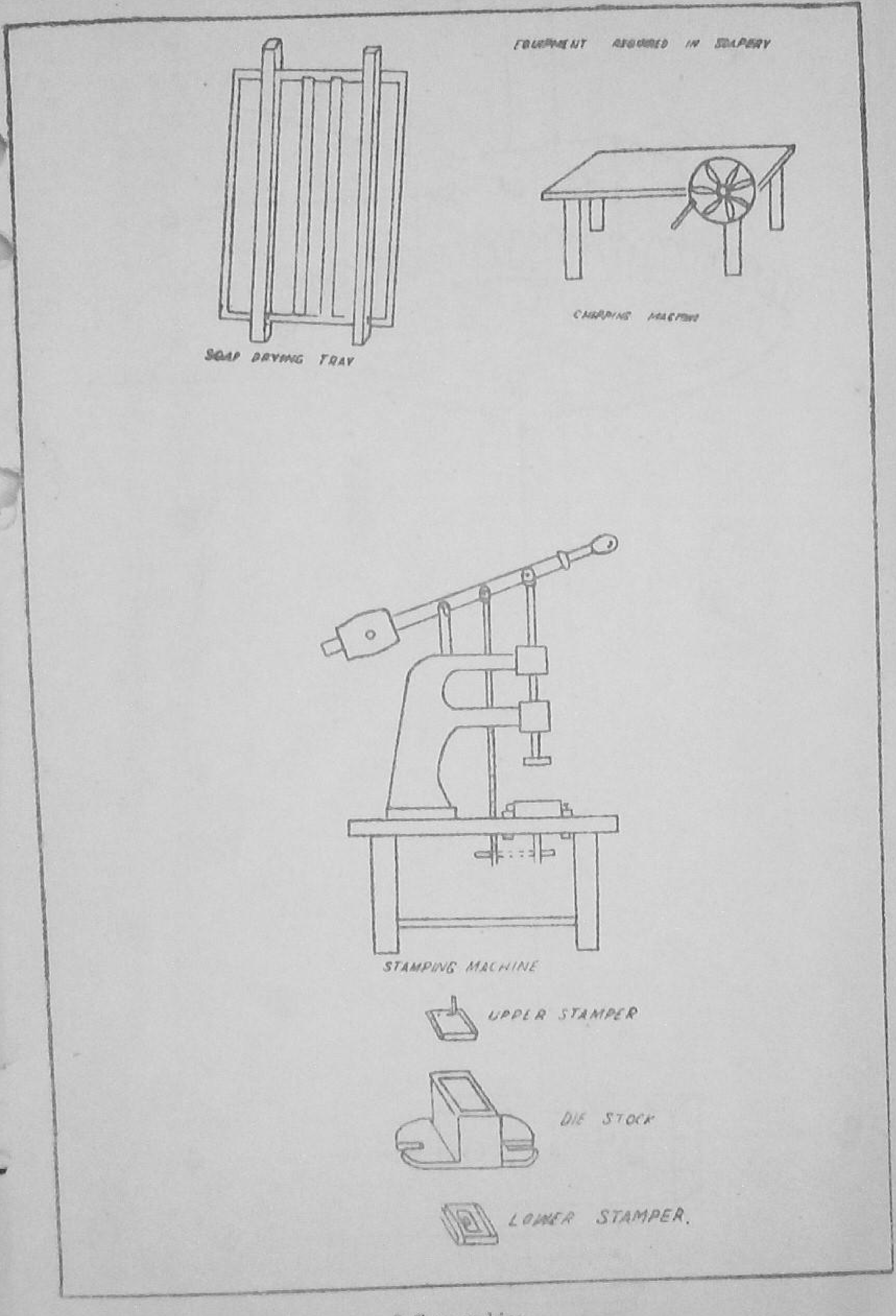


SPEED WHEEL

1. Pedestal
2. Oiling Hole
3. Machine Screw
4. Gear wheel with 16 teeth
5. Shaft
6. Flange
7. Three Steps wooden pulley
8. Screw

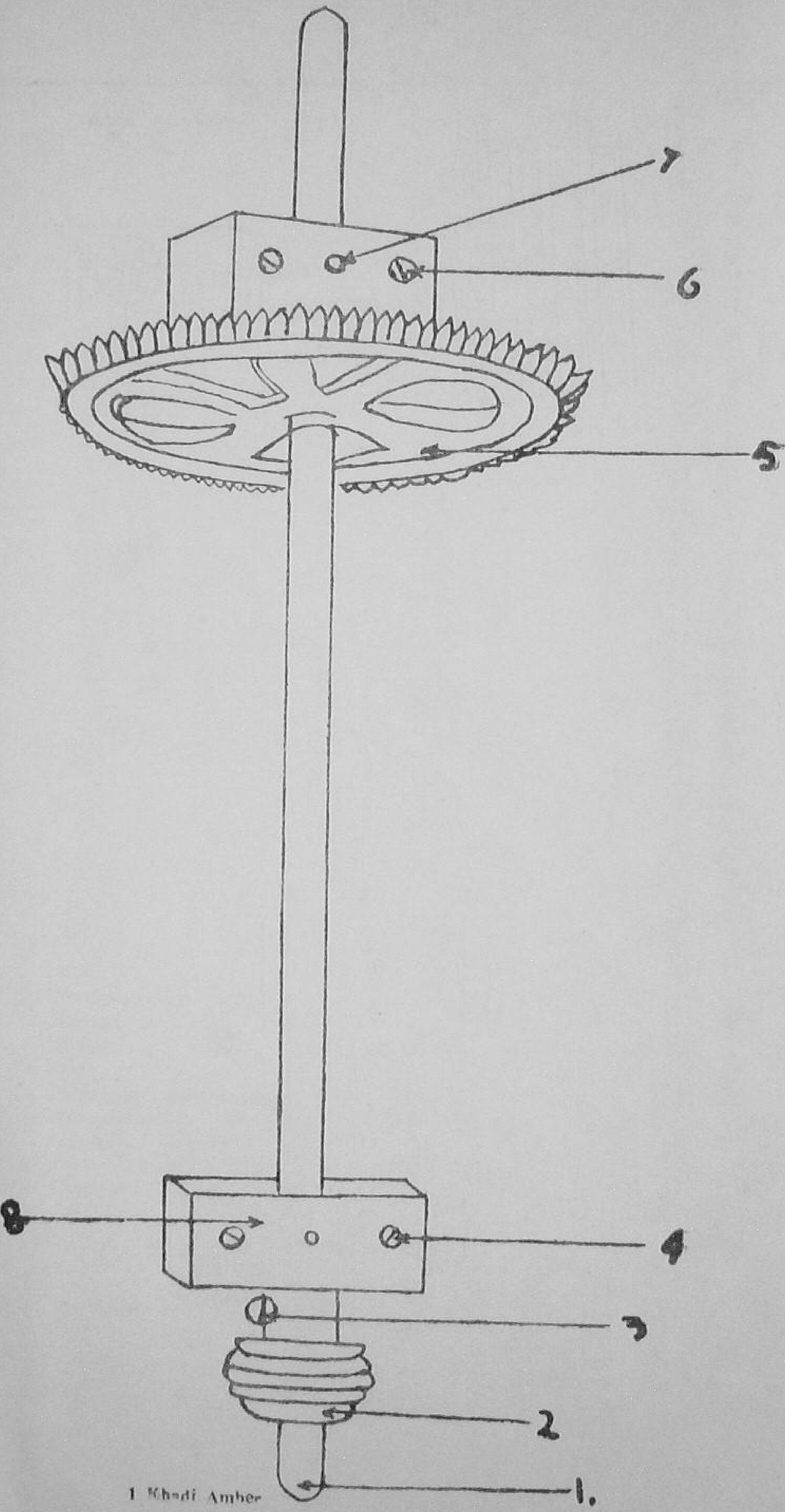
BELNI MODHIA

1. Wooden Pulley
2. Wooden Bearing Piece
3. Rubber Roller shaft
4. Rubber roller
5. Flange
6. Wooden Pulley
7. Fluted Roller
8. Flange



9 Soap making

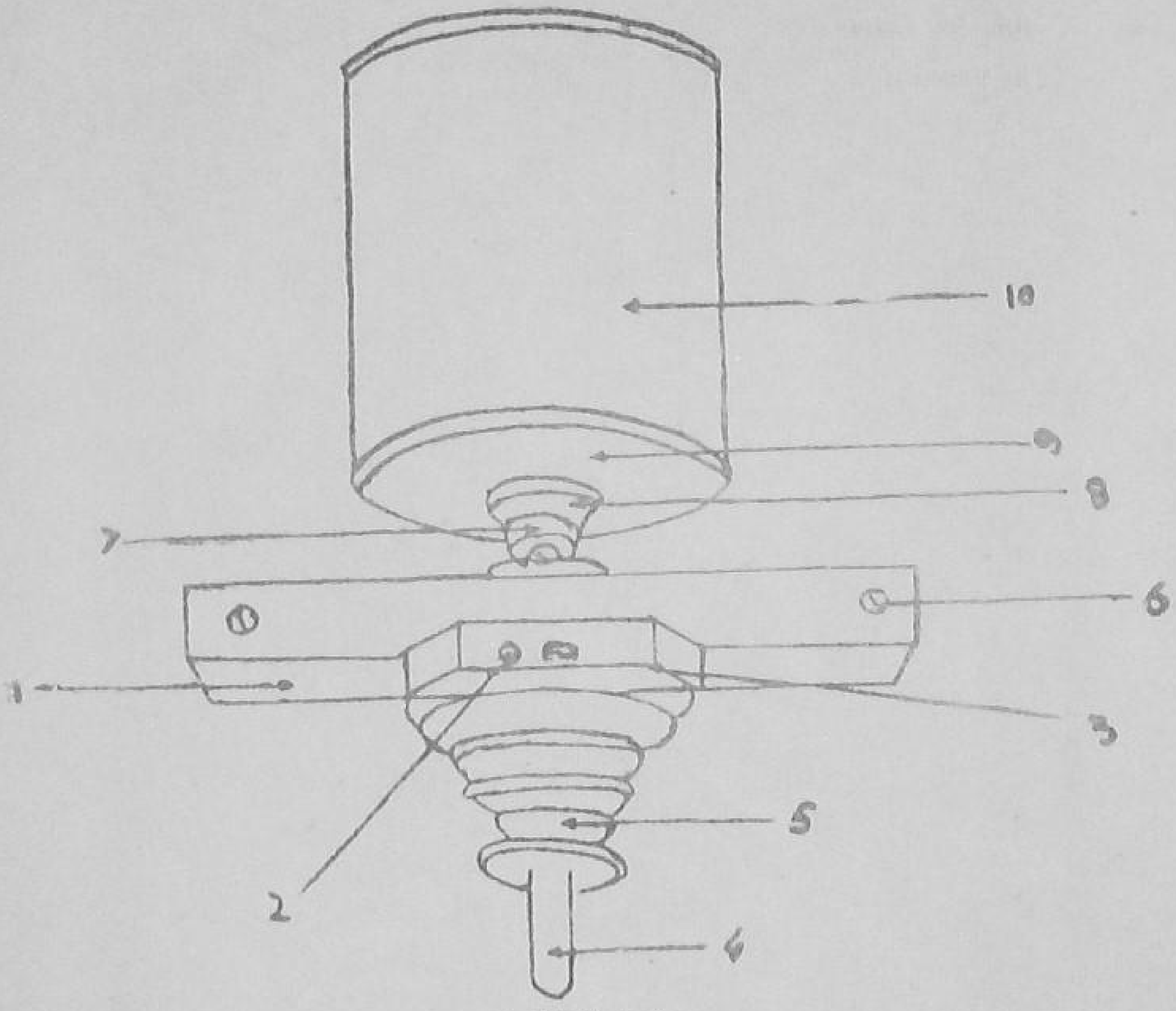
BELNI



MAIN WHEEL SHAFT

1. Shaft
2. Wooden Pulley
3. Flange
4. Wood Screw
5. Gear which with 100 Teeth
6. Pedestal
7. Hole for Oiling
8. Pedestal

-BELNI-

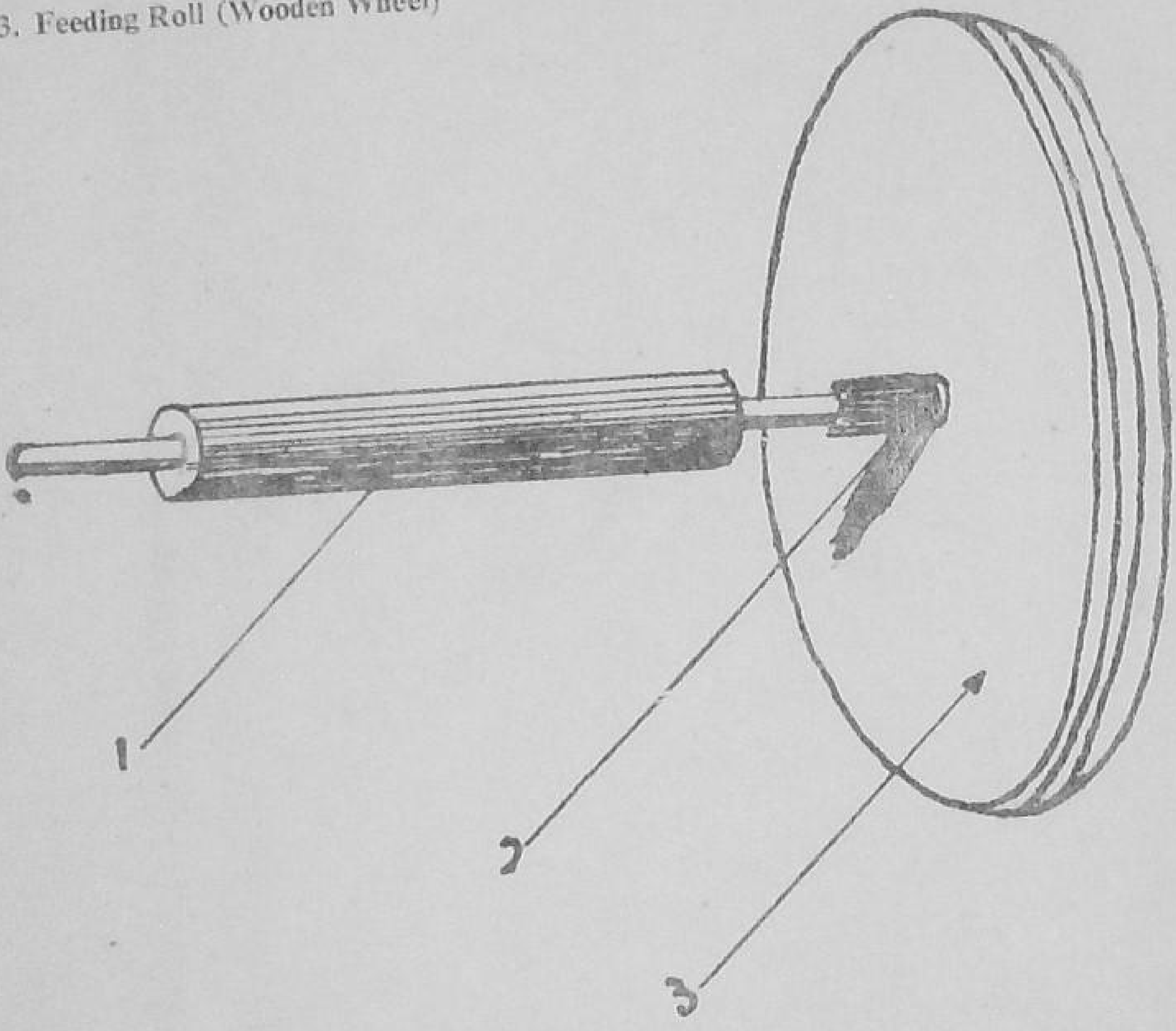


1 Khadi Amber

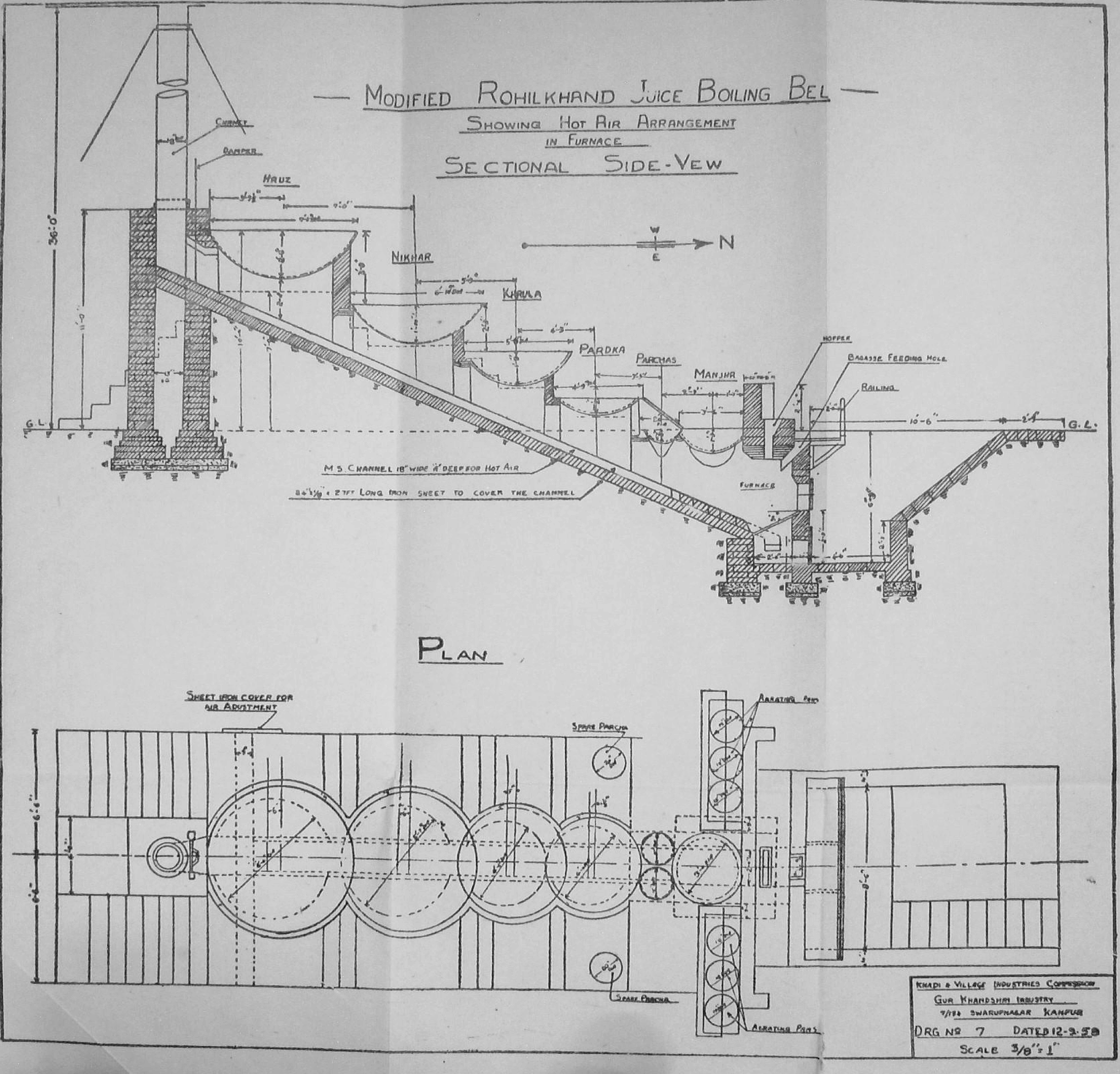
1. Wonden sepporting Rail
2. Mezcoin screw
3. Flange
4. Shaft
5. Three groove wooden pulley
6. Wood Screw
7. Flange
8. Manchine Screw
9. Can Supporter made of Teal wood
10. Can

DHUNAI · MODHIA ·

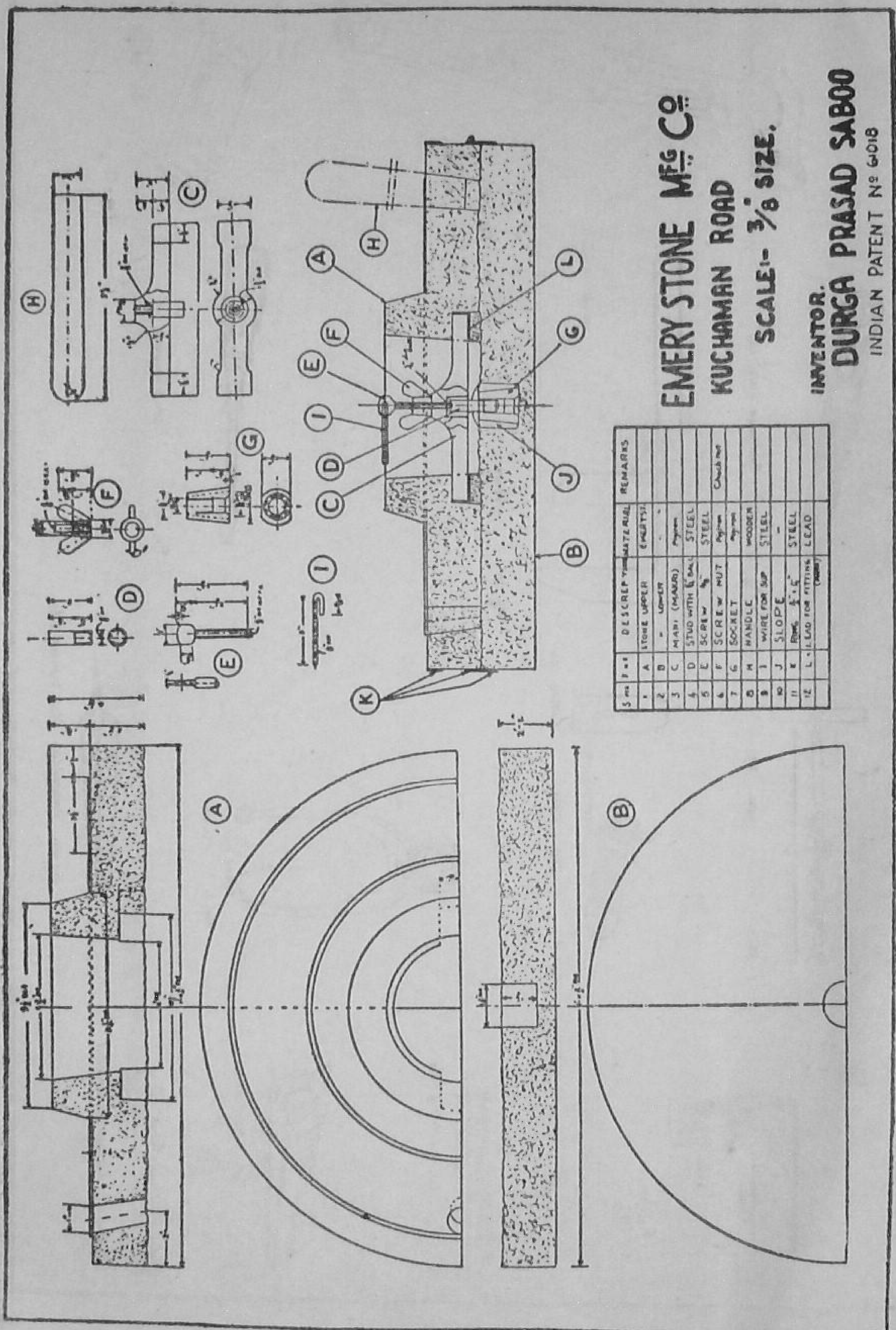
1. Fluted Roller
2. Flange
3. Feeding Roll (Wooden Wheel)



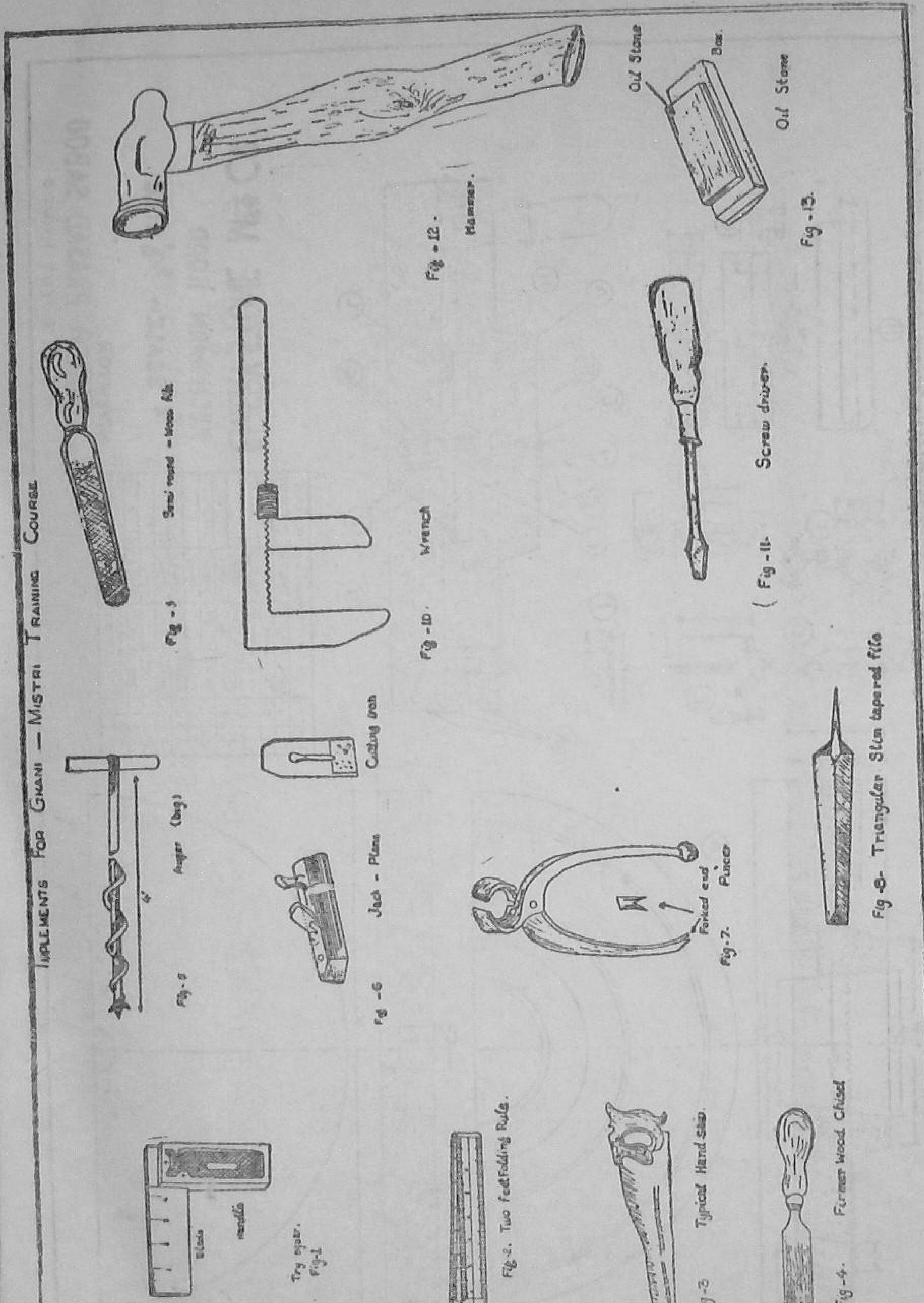
1 Khadi Amber



— MODIFIED ROHILKHAND JUICE BOILING BEL —
SHOWING HOT AIR ARRANGEMENT IN FURNACE
SECTIONAL SIDE-VEW
CHIMNEY
DAMPER
HAUZ
NIKHAR
KHRULA
PARDKA
PARCHAS
MANJHA
HOPPER
BAGASSE FEEDING HOLE
RAILING
FURNACE
G.L.
36'-0"
10'-6"
W
E
N
M.S. CHANNEL 18" WIDE 4" DEEP FOR HOT AIR
27FT LONG IRON SHEET TO COVER THE CHANNEL
PLAN
SHEET IRON COVER FOR AIR ADJUSTMENT
SPARE PARCHA
AERATING PANS
KHADI & VILLAGE INDUSTRIES COMMISSION
GUR KHANDSARI INDUSTRY
7/184 SWARUPNAGAR KANPUR
DRG NO 7 DATED 12-9-58
SCALE 3/8" = 1"



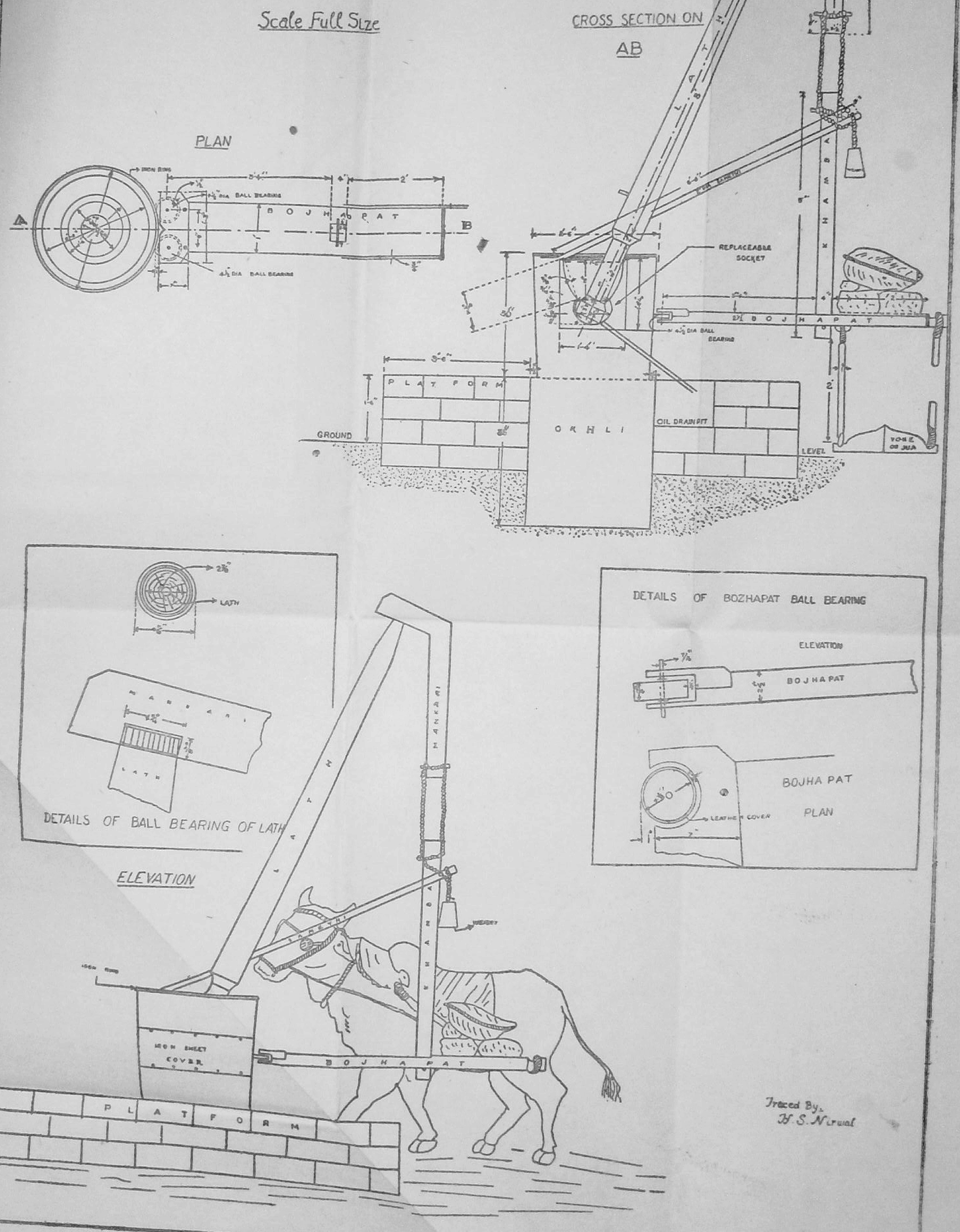
4. **Hand Pounding**

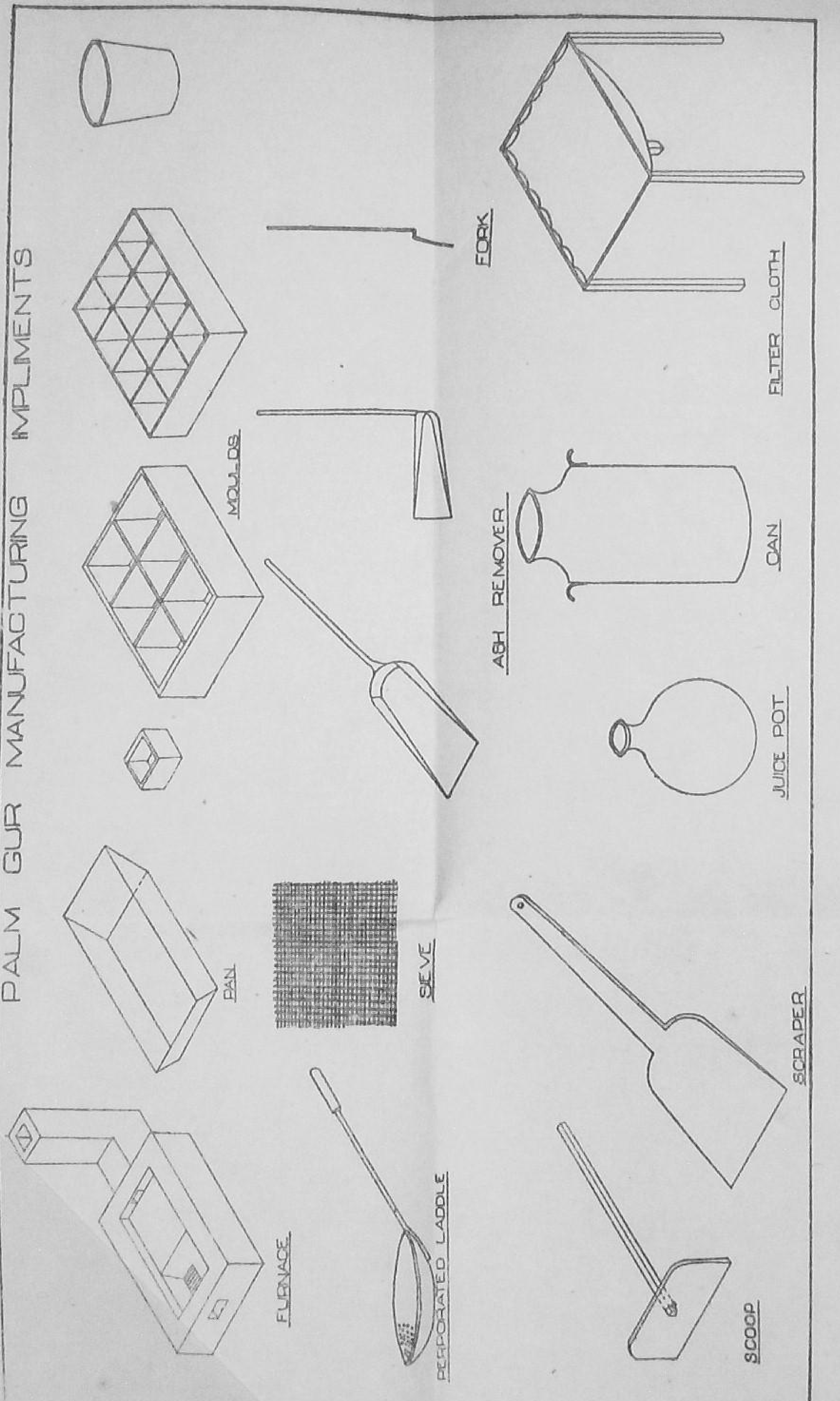


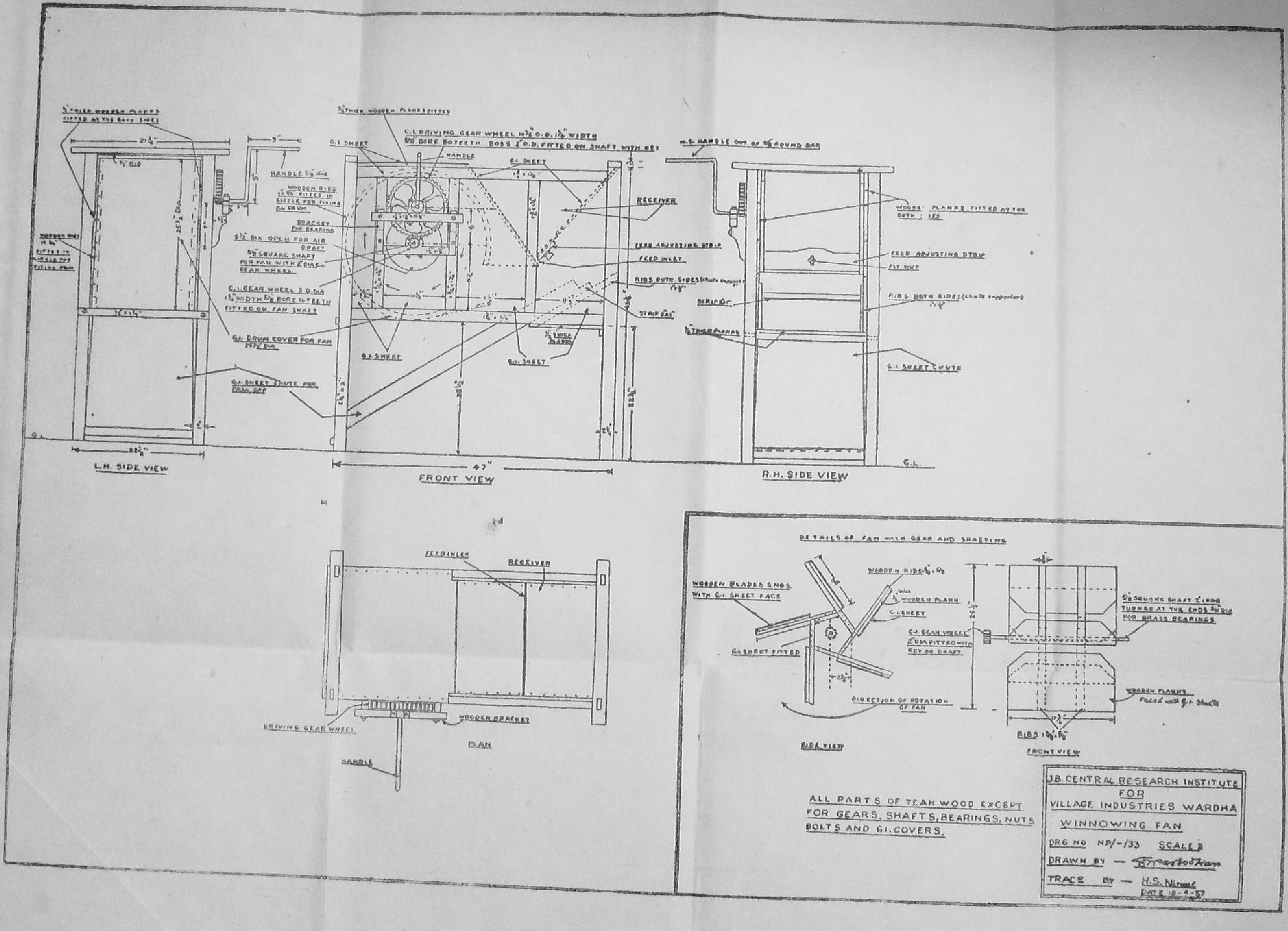
9. Village Chani

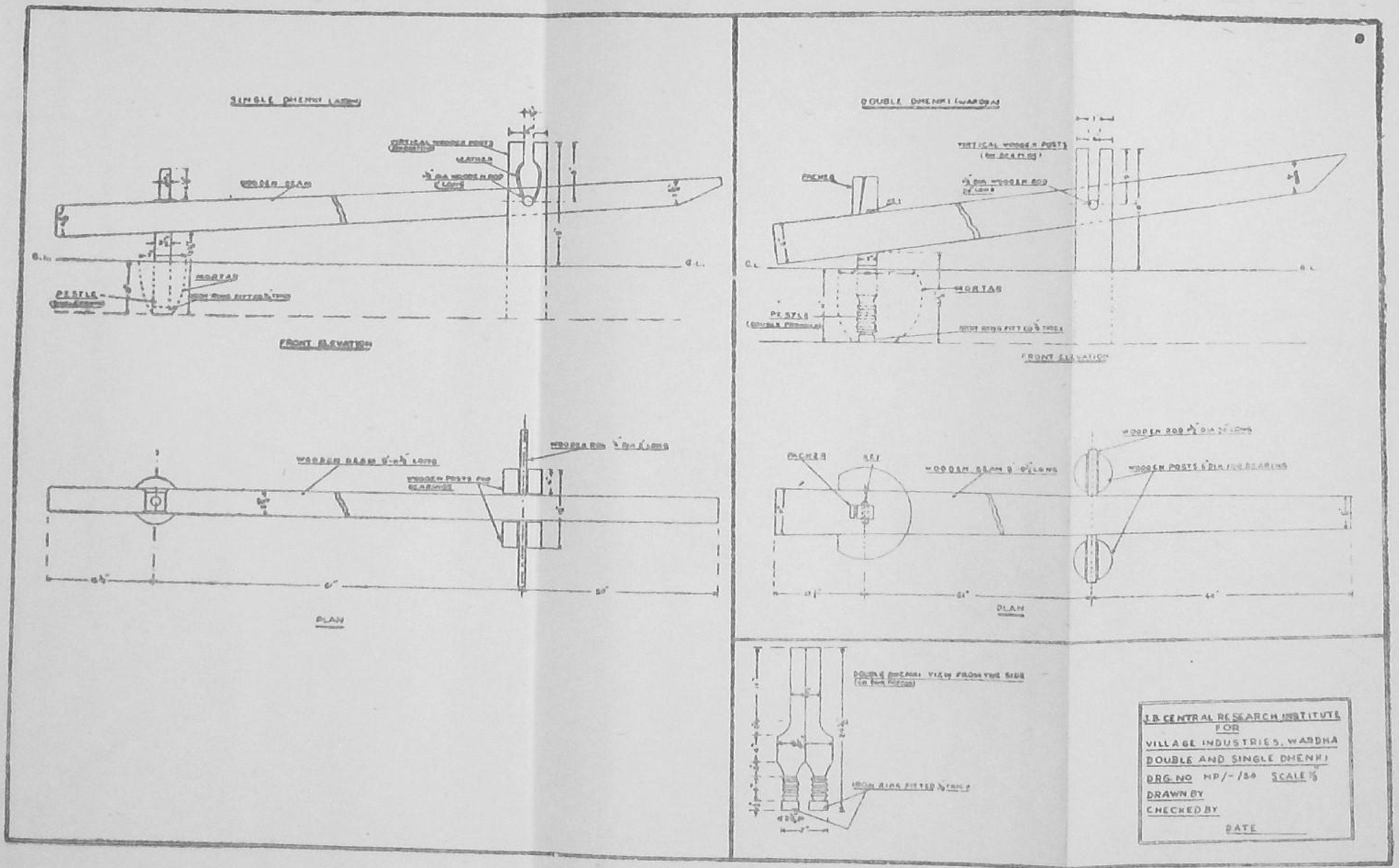
PLAN OF THE IMPROVED

MAGANWADI GHANI WARDHA

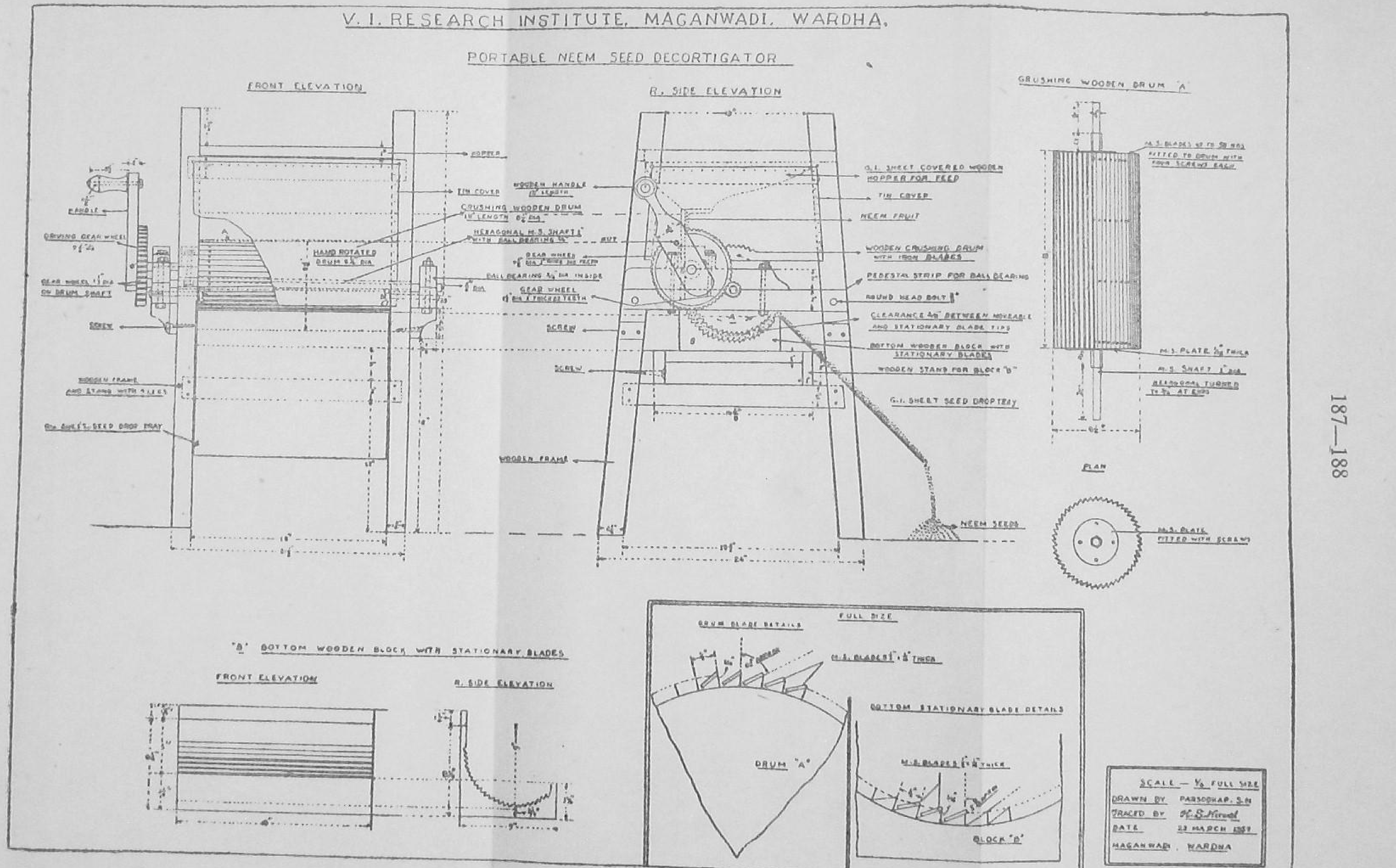



PALM GUR MANUFACTURING IMPLIMENTS
FURNACE
PAN
MOULDS
FORK
PERFORATED LADDLE
SIEVE
ASH REMOVER
CAN
FILTER CLOTH
SCOOP
SCRAPER
JUICE POT

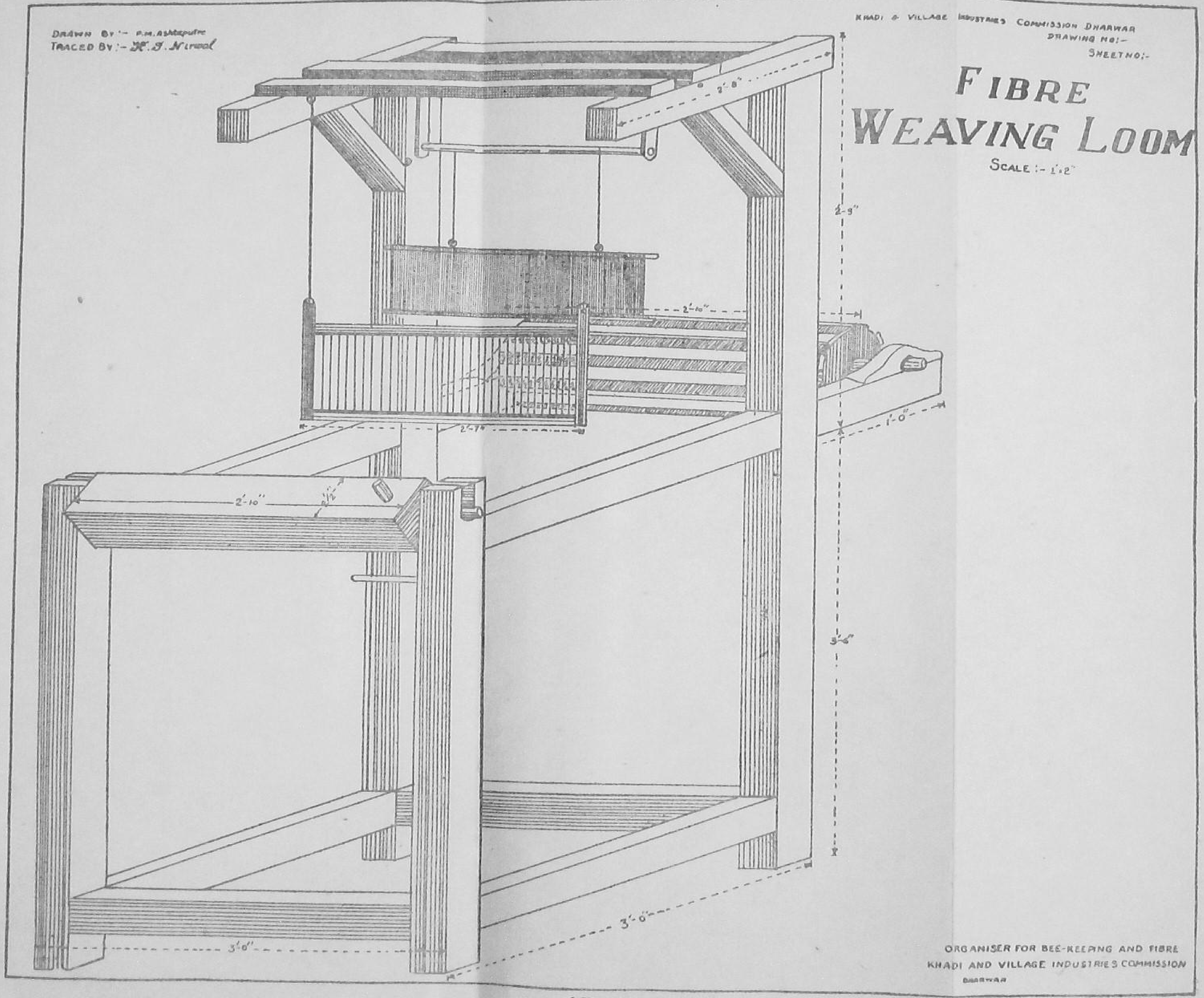

L.H. SIDE VIEW
FRONT VIEW
R.H. SIDE VIEW
47"
RECEIVER
FEED ADJUSTING STRIP
FEED INLET
G.I. SHEET
G.I. SHEET CHUTE
HANDLE
FEED INLET
RECEIVER
DRIVING GEAR WHEEL
WOODEN BRACKET
PLAN
DETAILS OF FAN WITH GEAR AND SHAFTING
DIRECTION OF ROTATION OF FAN
SIDE VIEW
FRONT VIEW
ALL PARTS OF TEAK WOOD EXCEPT
FOR GEARS, SHAFTS, BEARINGS, NUTS
BOLTS AND G.I. COVERS.
J.B. CENTRAL RESEARCH INSTITUTE
FOR
VILLAGE INDUSTRIES WARDHA
WINNOWING FAN
DRG NO HP/-/33 SCALE
DRAWN BY —
TRACE BY — H.S. Nirmal



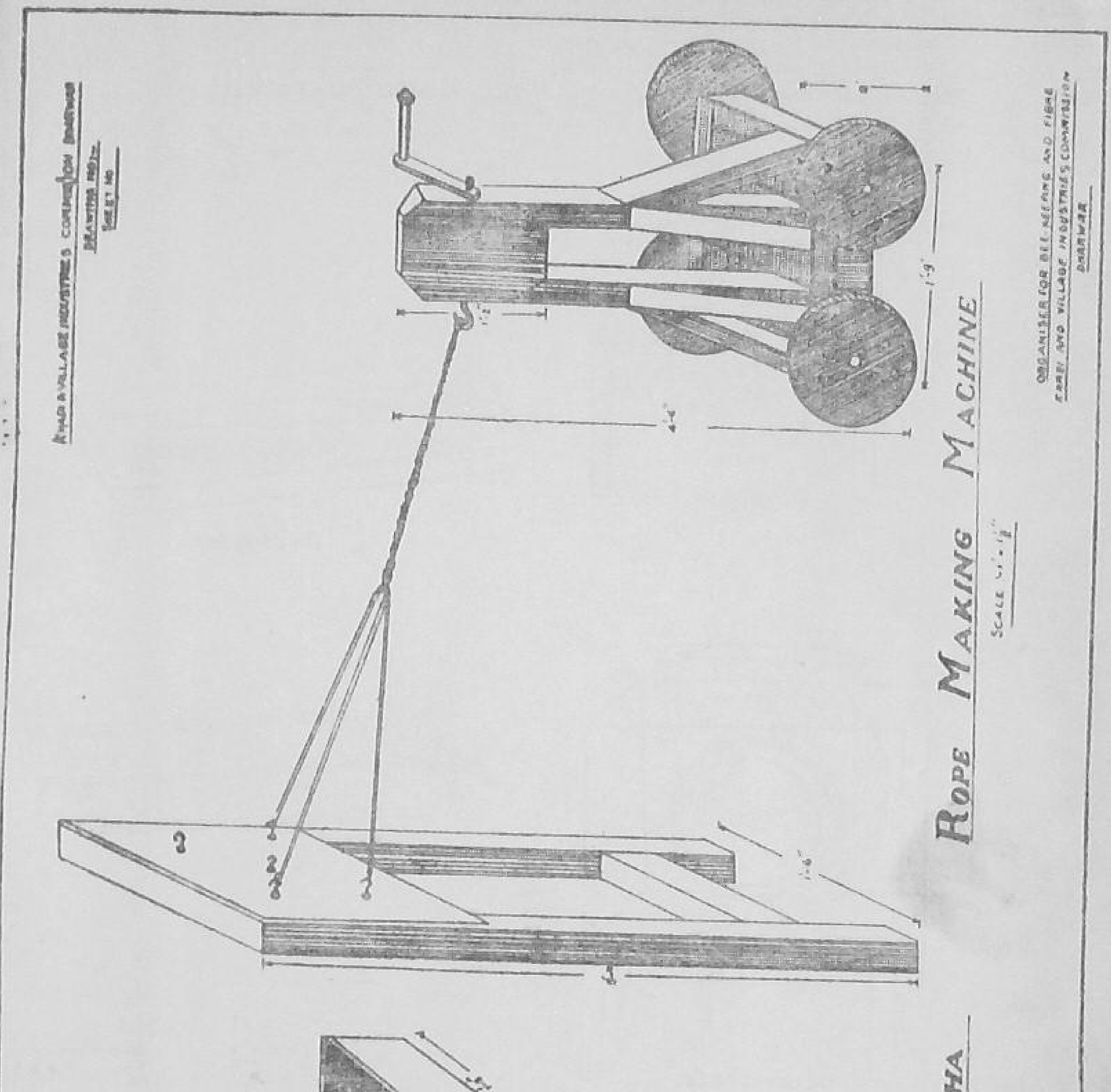
4 Hand Pounding



4 Hand Pounding

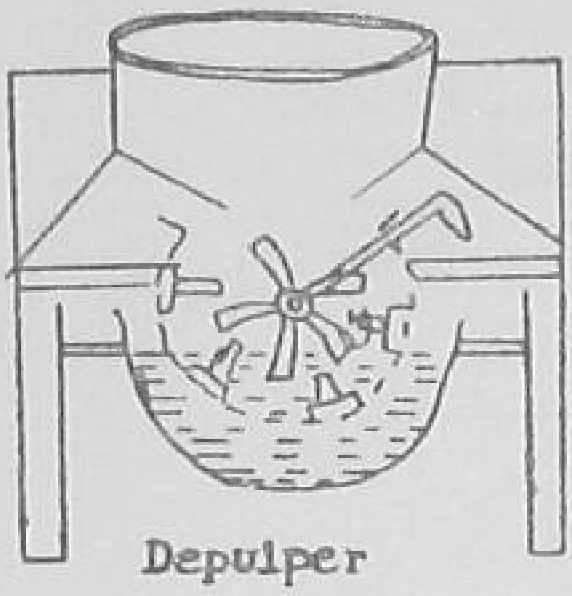


6 Fibre Industry

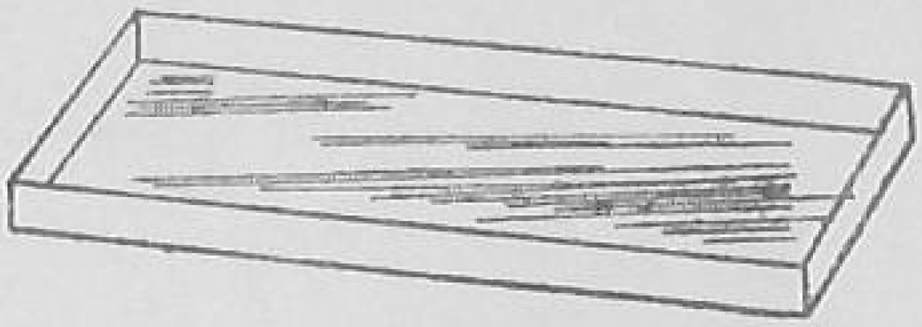

ROPE MAKING MACHINE
FIBRE SPINNING CHARKHA

NON-EDIBLE OILS & SOAP INDUSTRY
KHADI & VILLAGE INDUSTRIES COMMISSION
BOMBAY-1.

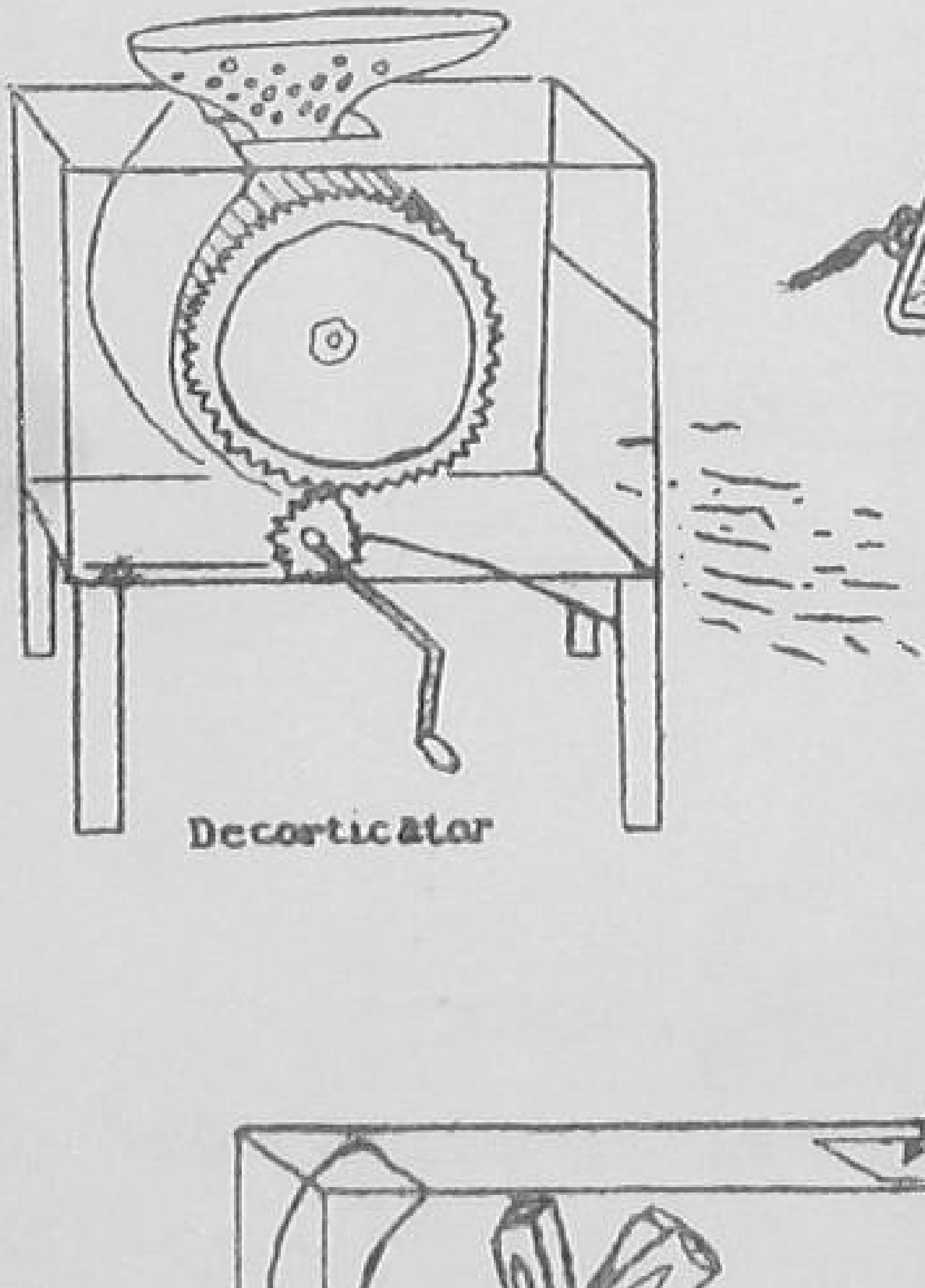
Equipment used in Processing of Non-edible Oilseeds.



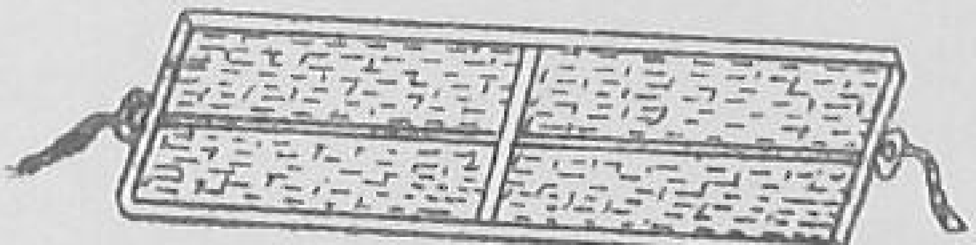
Depulper



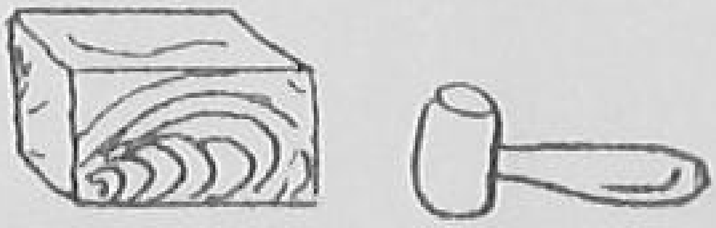
Drying tray.



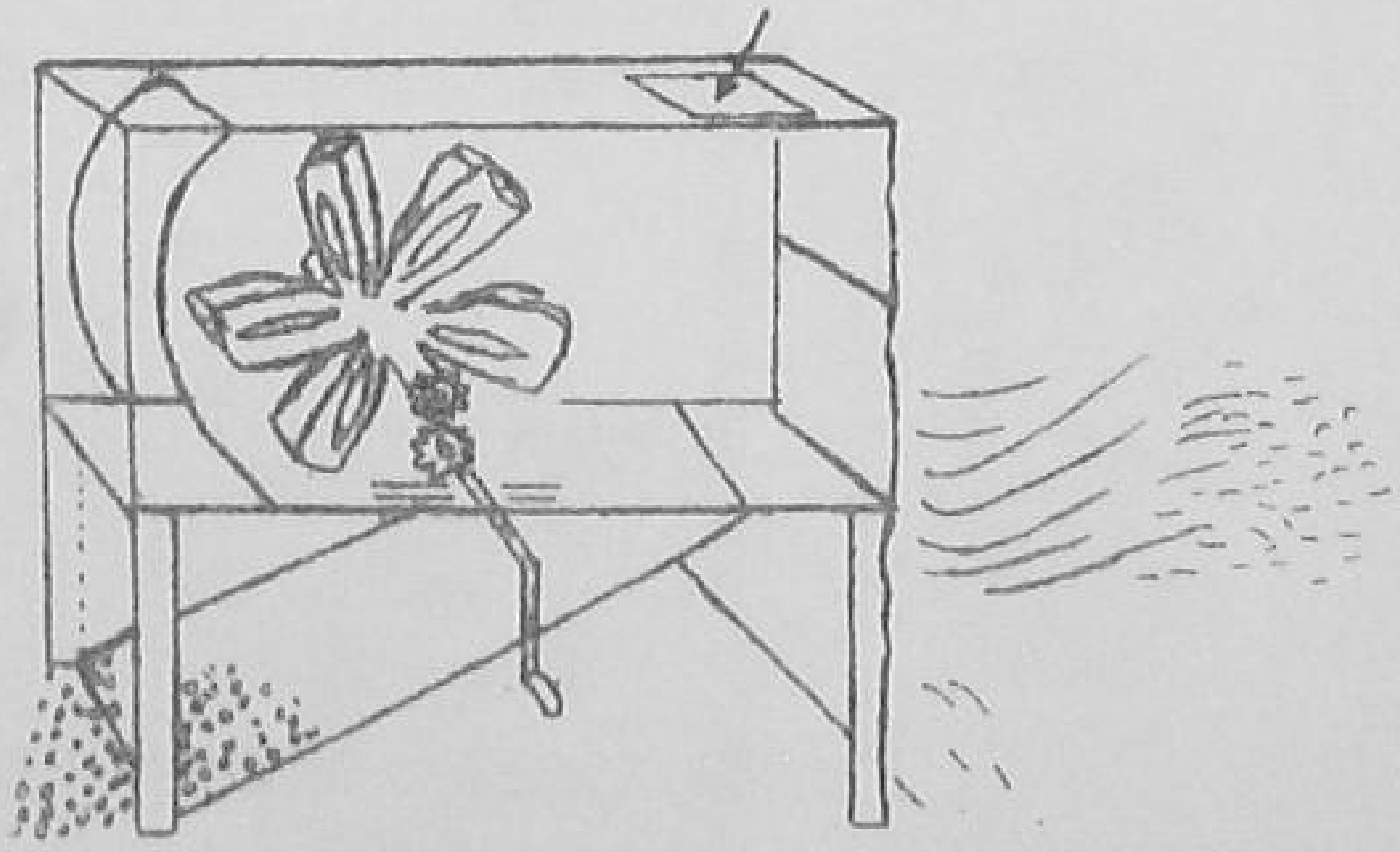
Decorticator



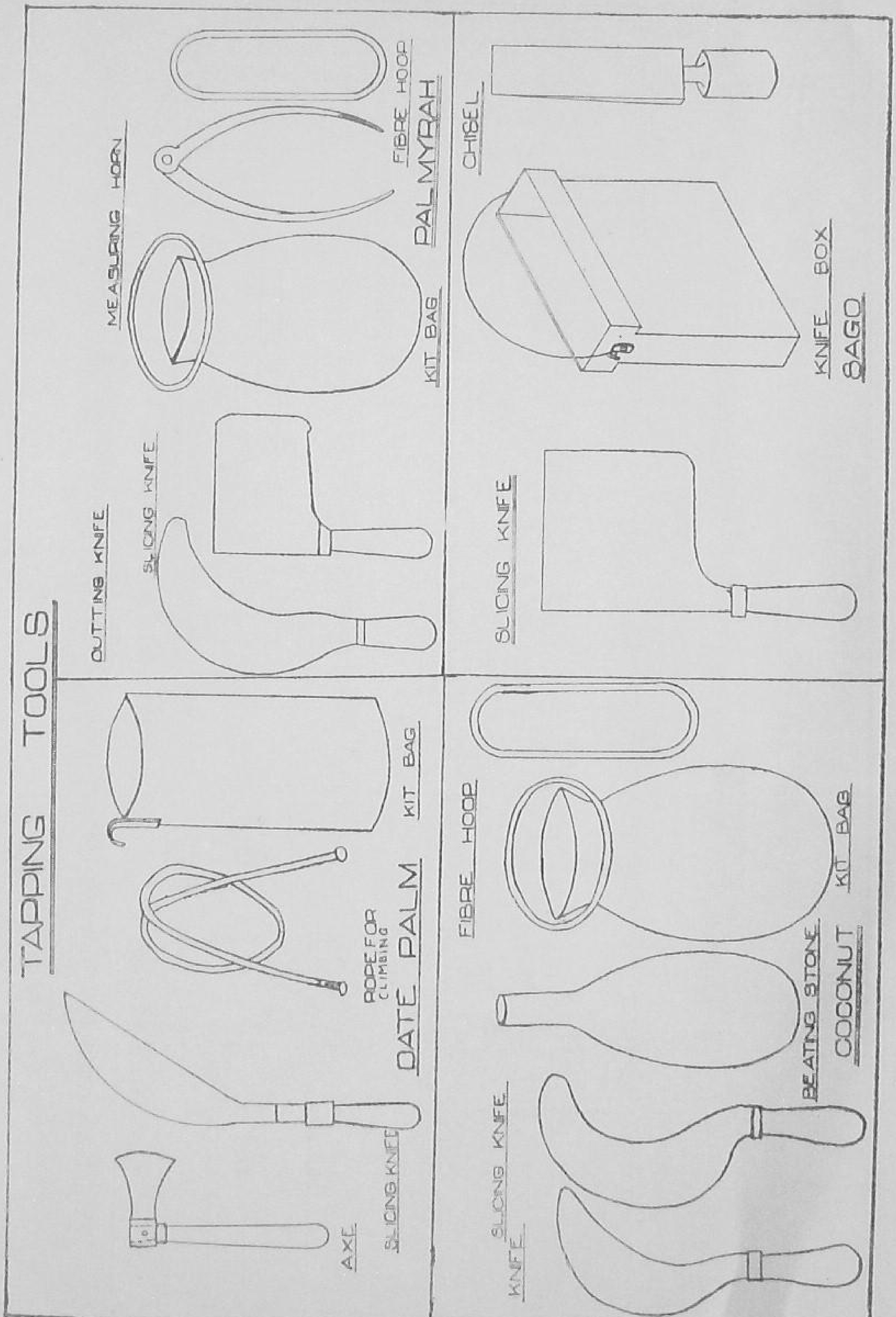
Sieve.



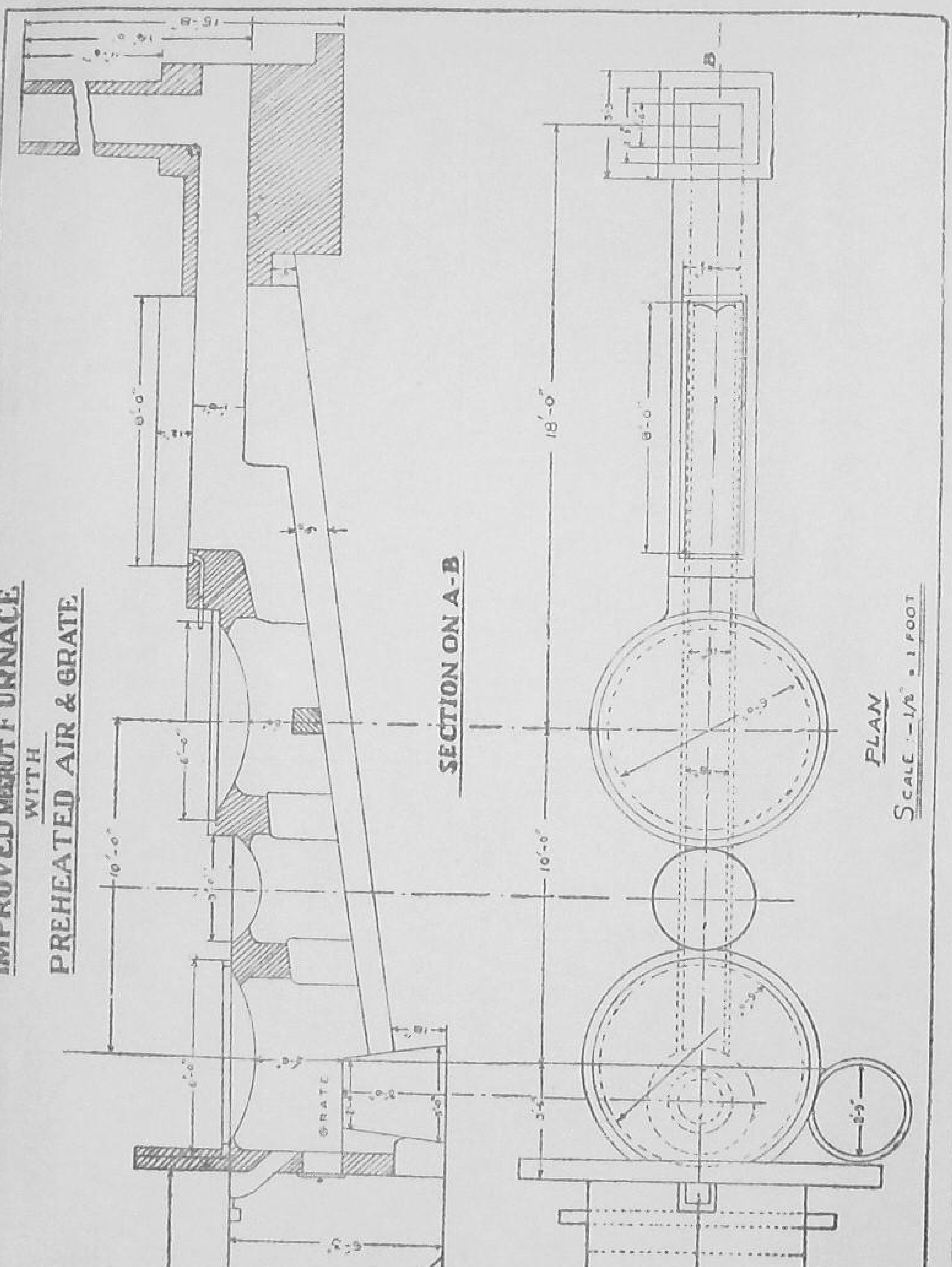
Wooden block & Hammer.

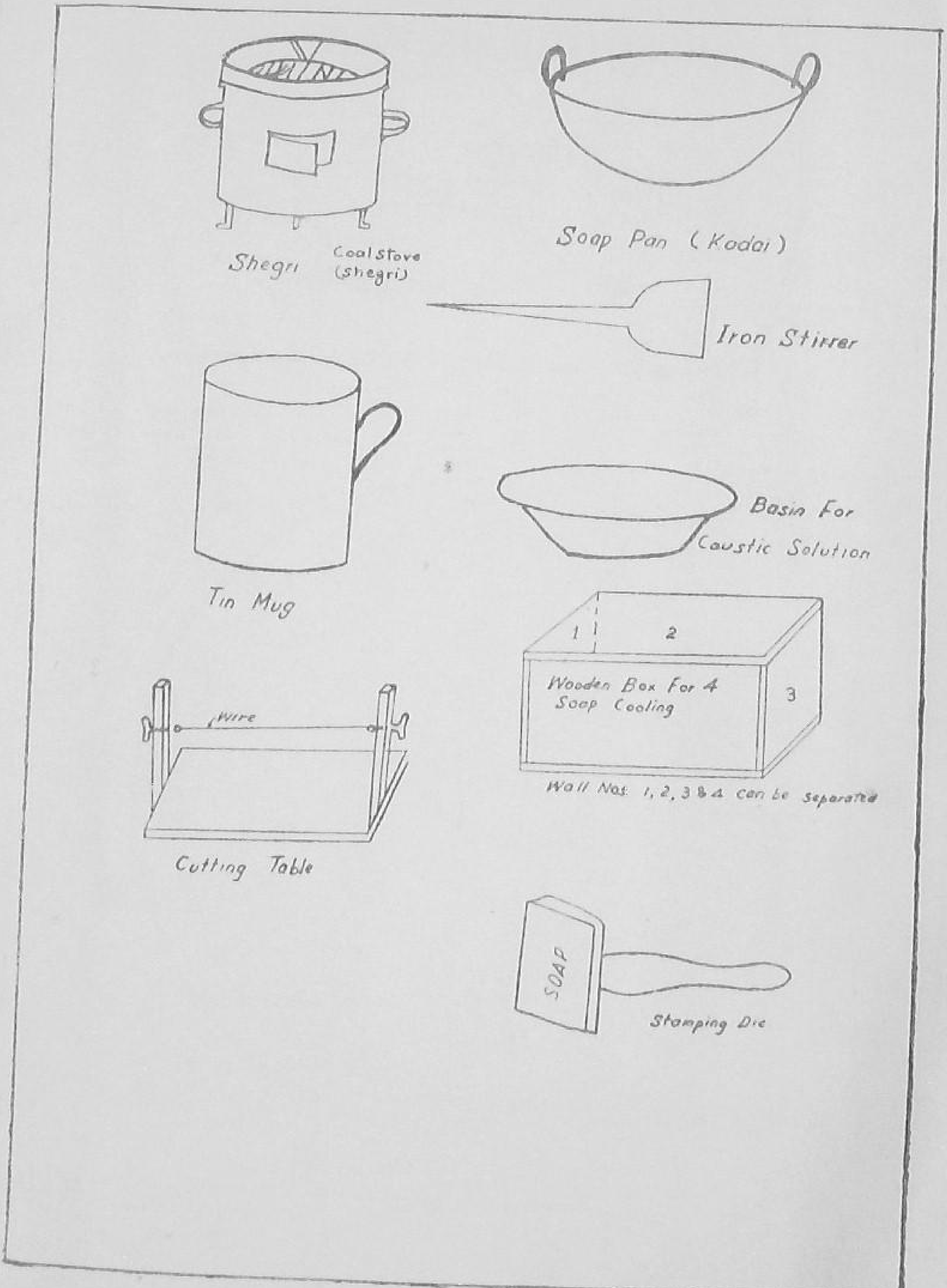


Winnower



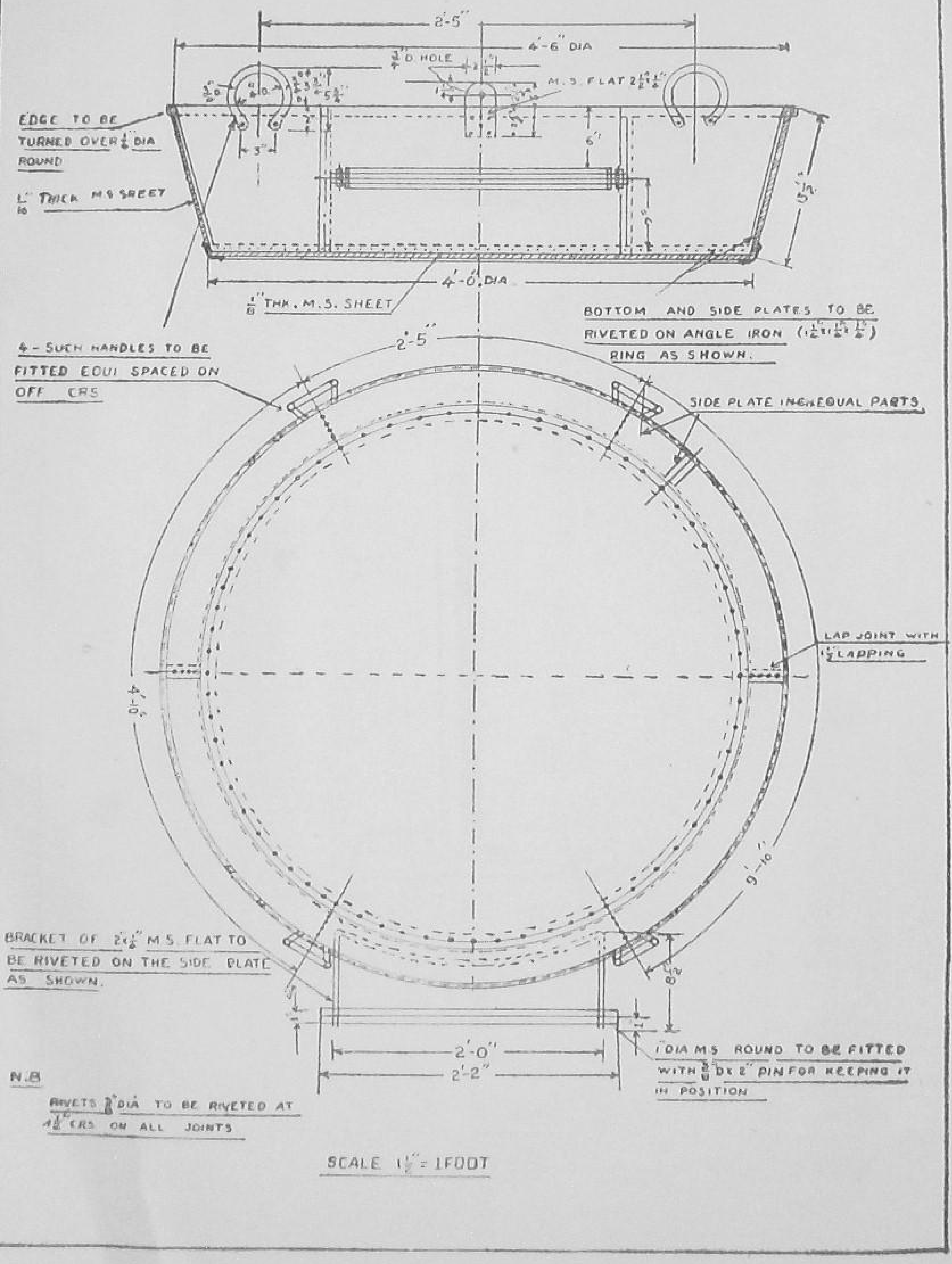
8 Palm Gur making


IMPROVED MEERUT FURNACE
WITH
PREHEATED AIR & GRATE
SECTION ON A-B
PLAN
SCALE 1/8" = 1 FOOT
GRATE
18'-0"
10'-0"
8'-0"

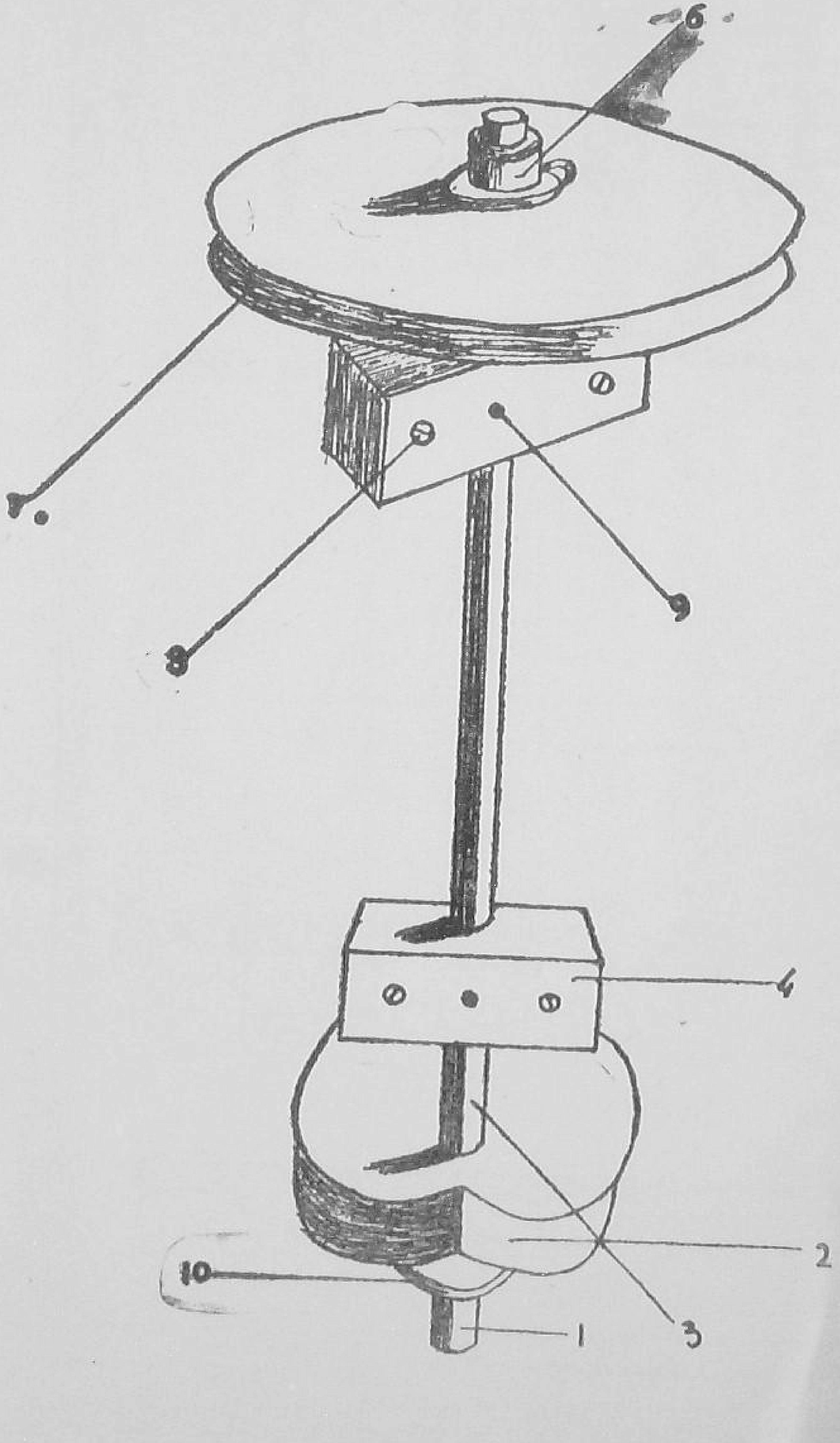


9 Soap making

JUICE BOILING PAN

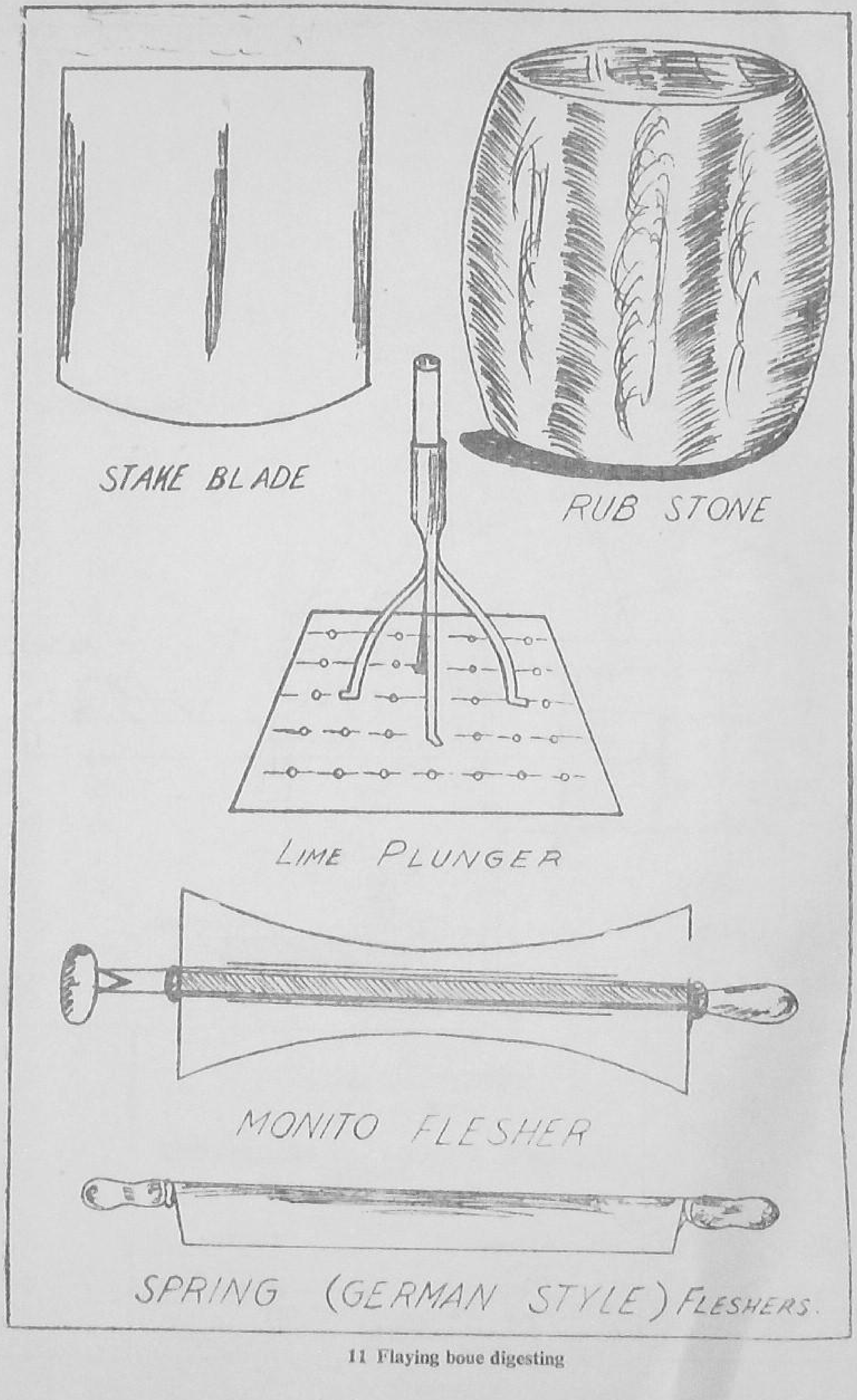


CHARKHA

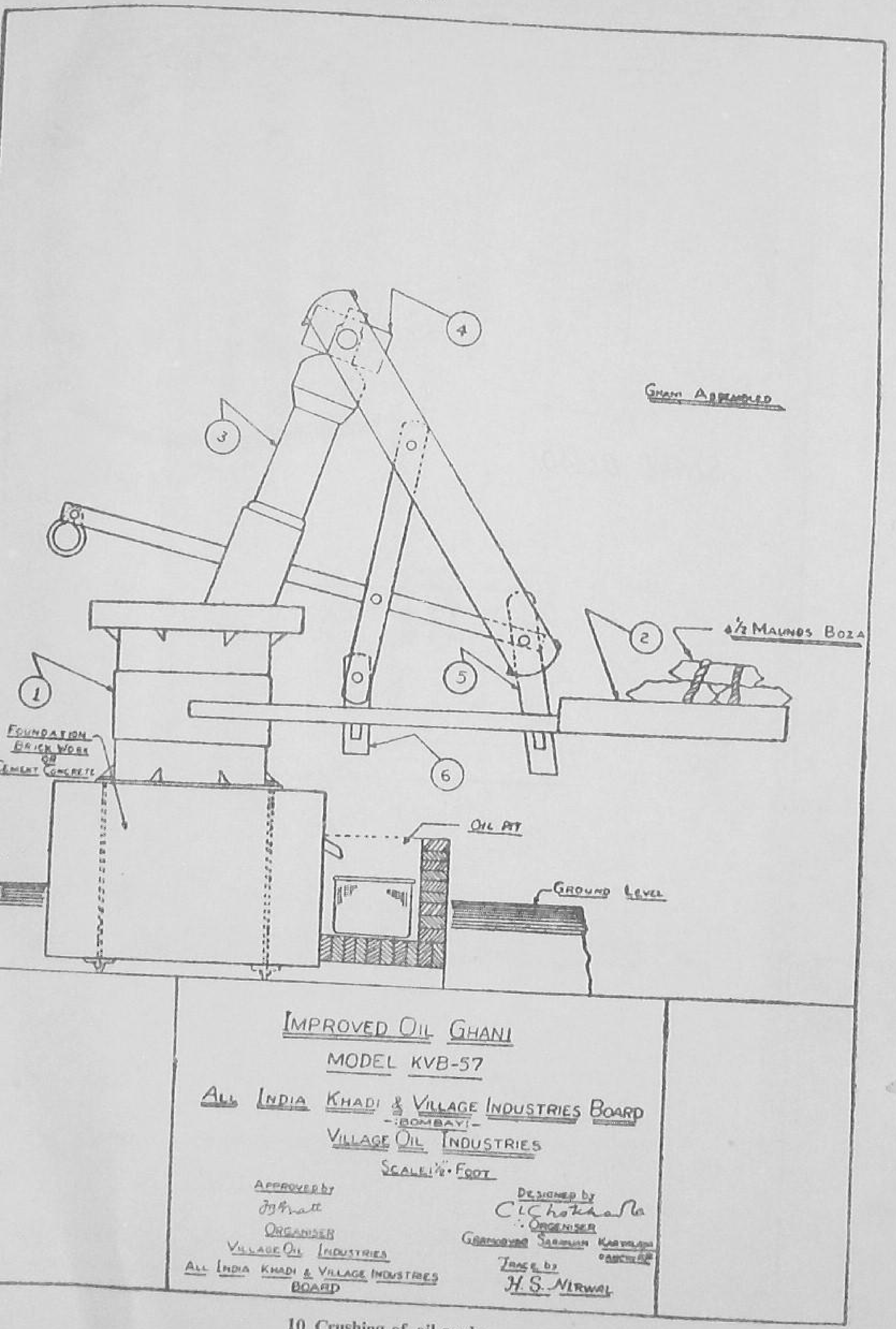


CAM WHEEL

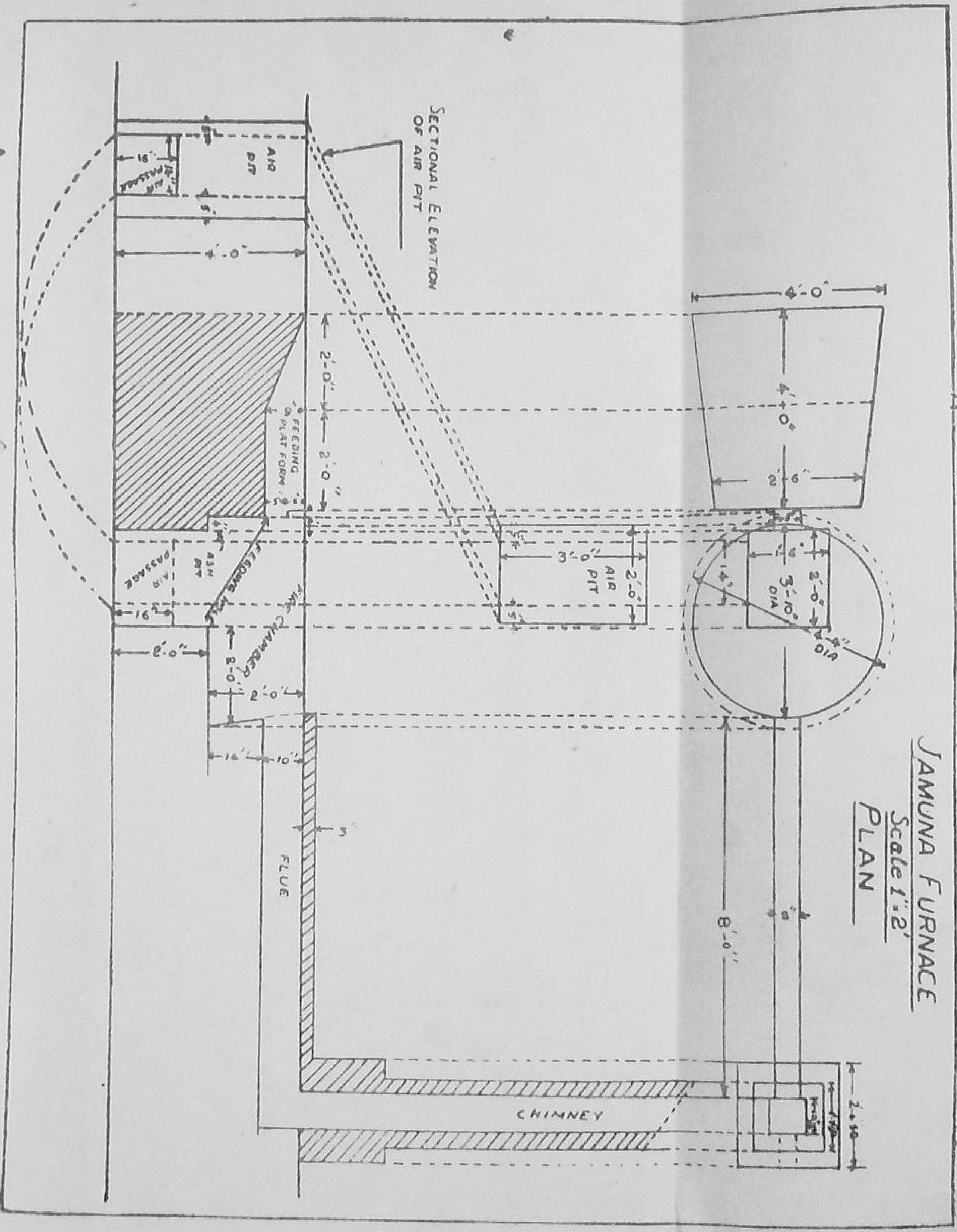
1. Shaft for cam Pulley
2. Cam
3. Com Shaft
4. Wooden bearing (made of sisam wood)
5. Automatic pulley (7'' Diameter)
6. Flange
7. Groove in automatic pulley
8. Wooden Screw
9. Place for oiling
10. Flange

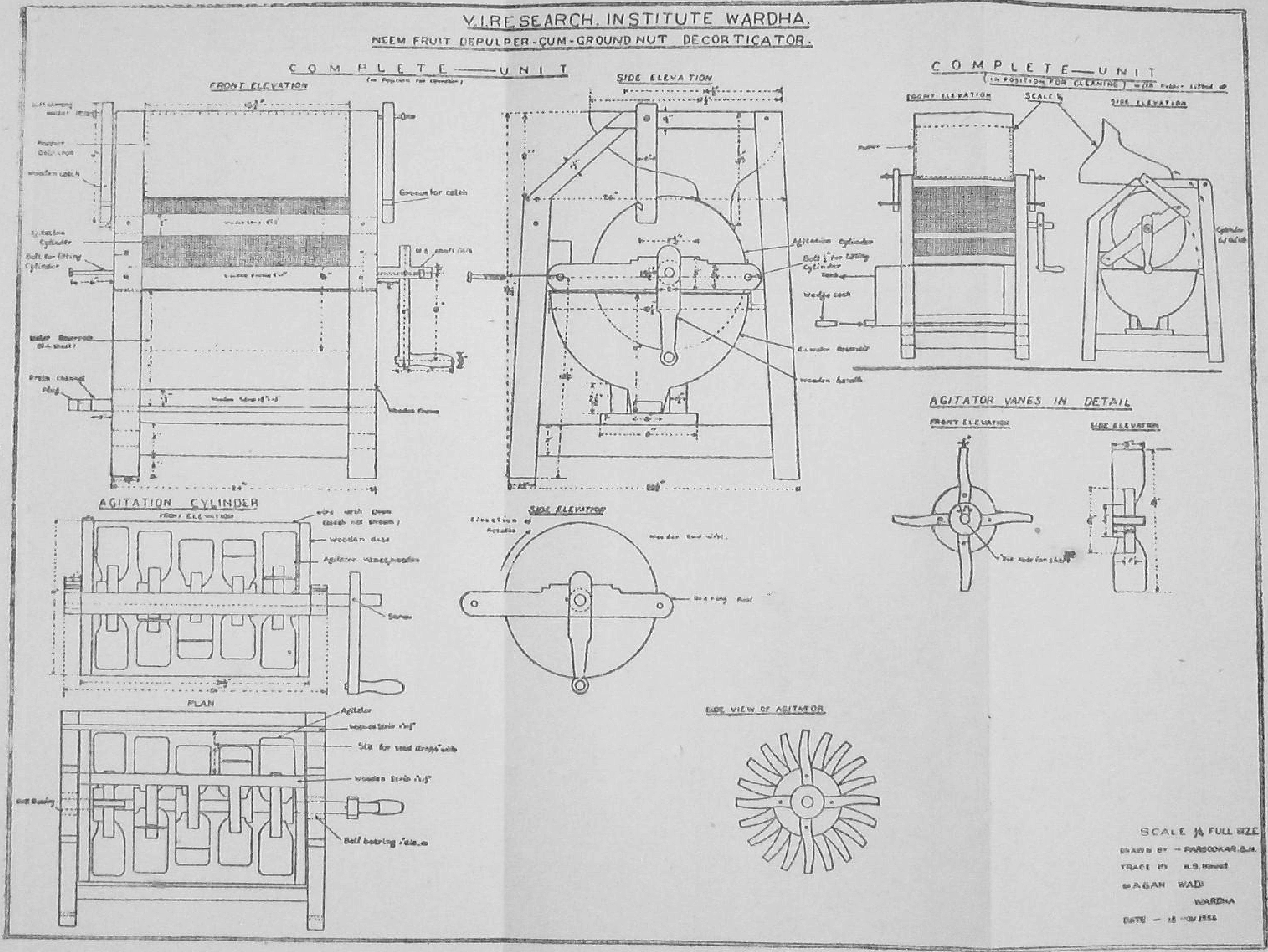


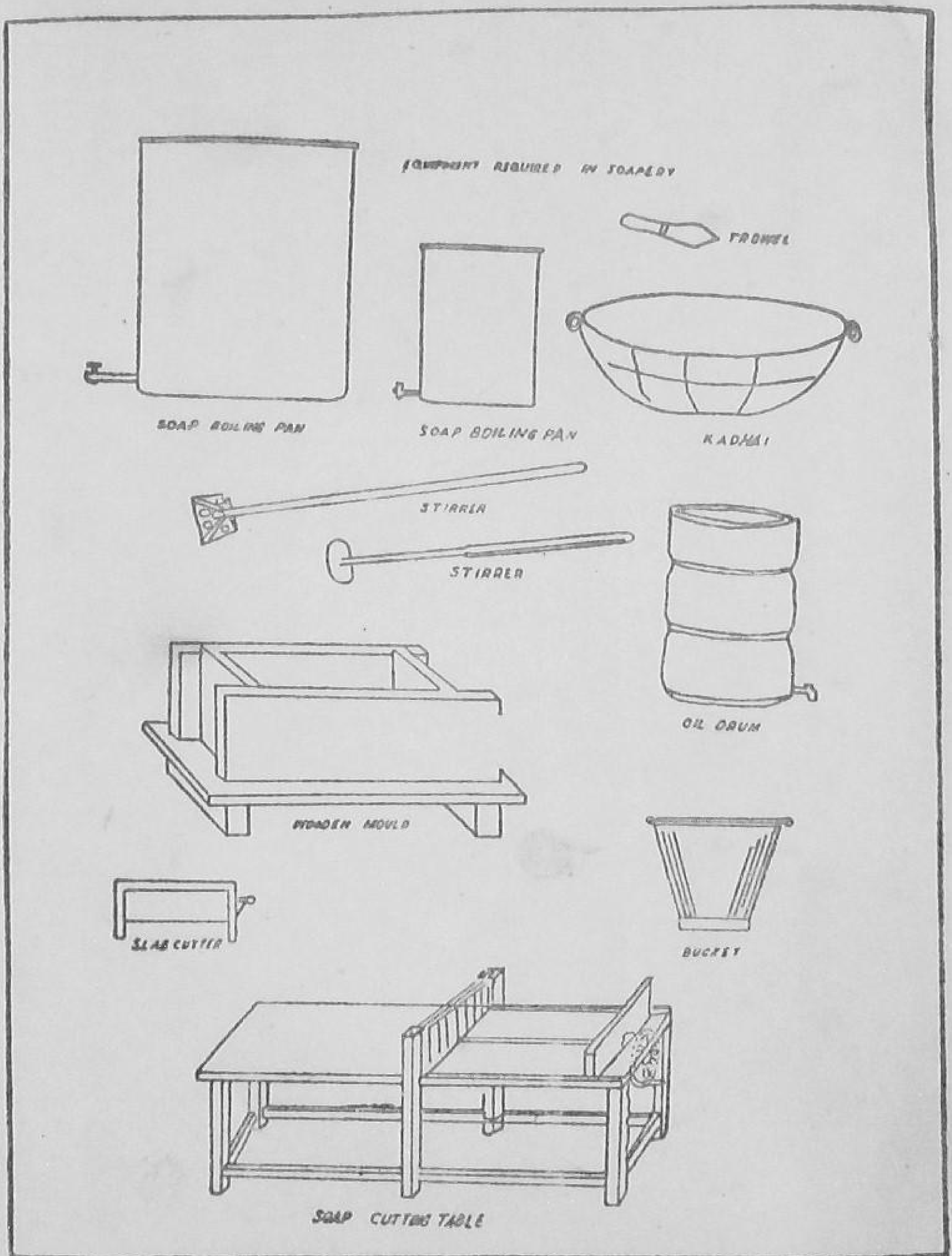
11 Flaying boue digesting



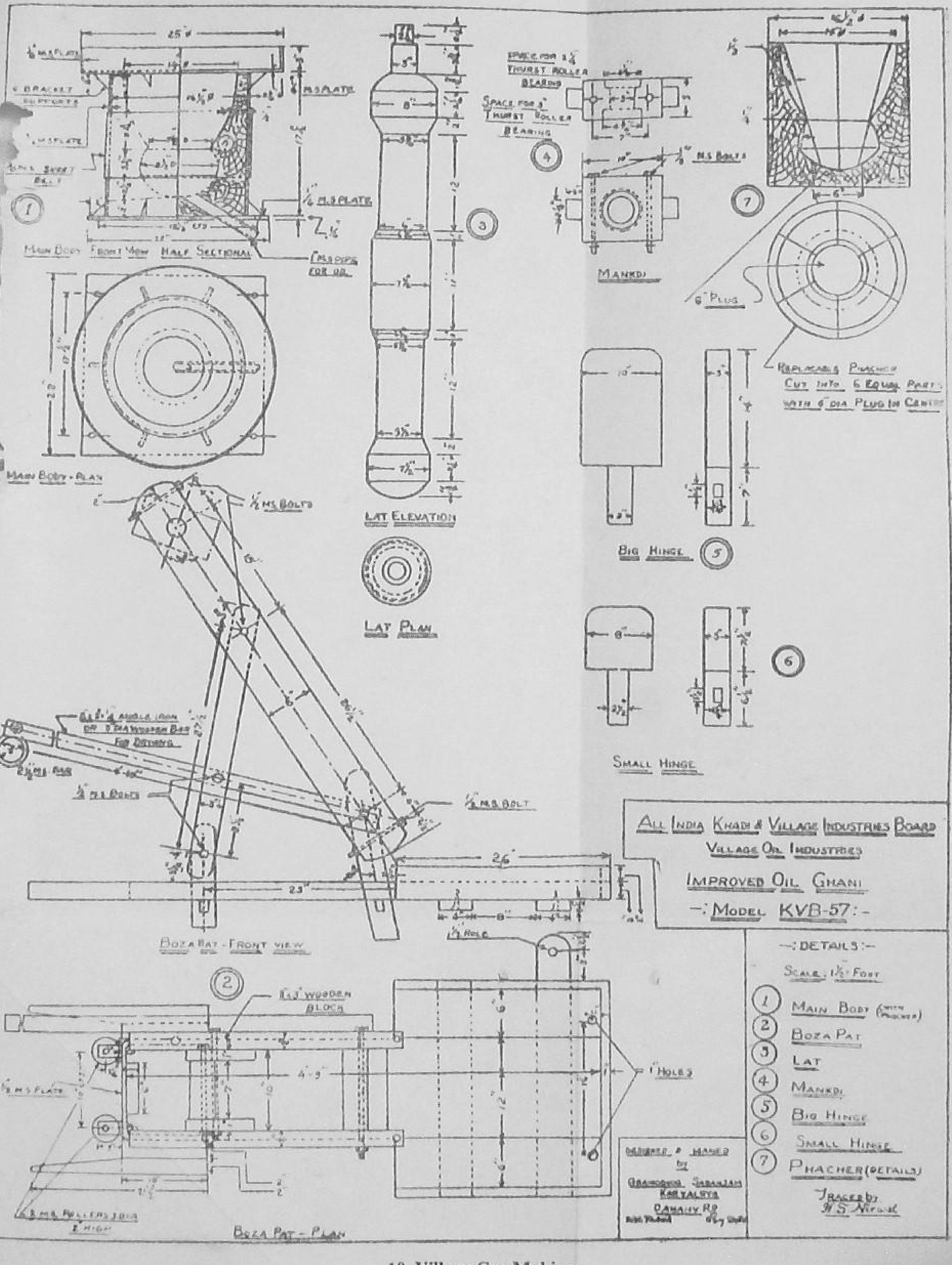
10 Crushing of oil seeds


JAMUNA FURNACE
Scale 1":2'
PLAN
SECTIONAL ELEVATION OF AIR PIT
AIR PIT
AIR PASSAGE
FEEDING PLAT FORM
ASH PIT
FEEDING HOLE
FIRE CHAMBER
FLUE
CHIMNEY
3'-10" DIA

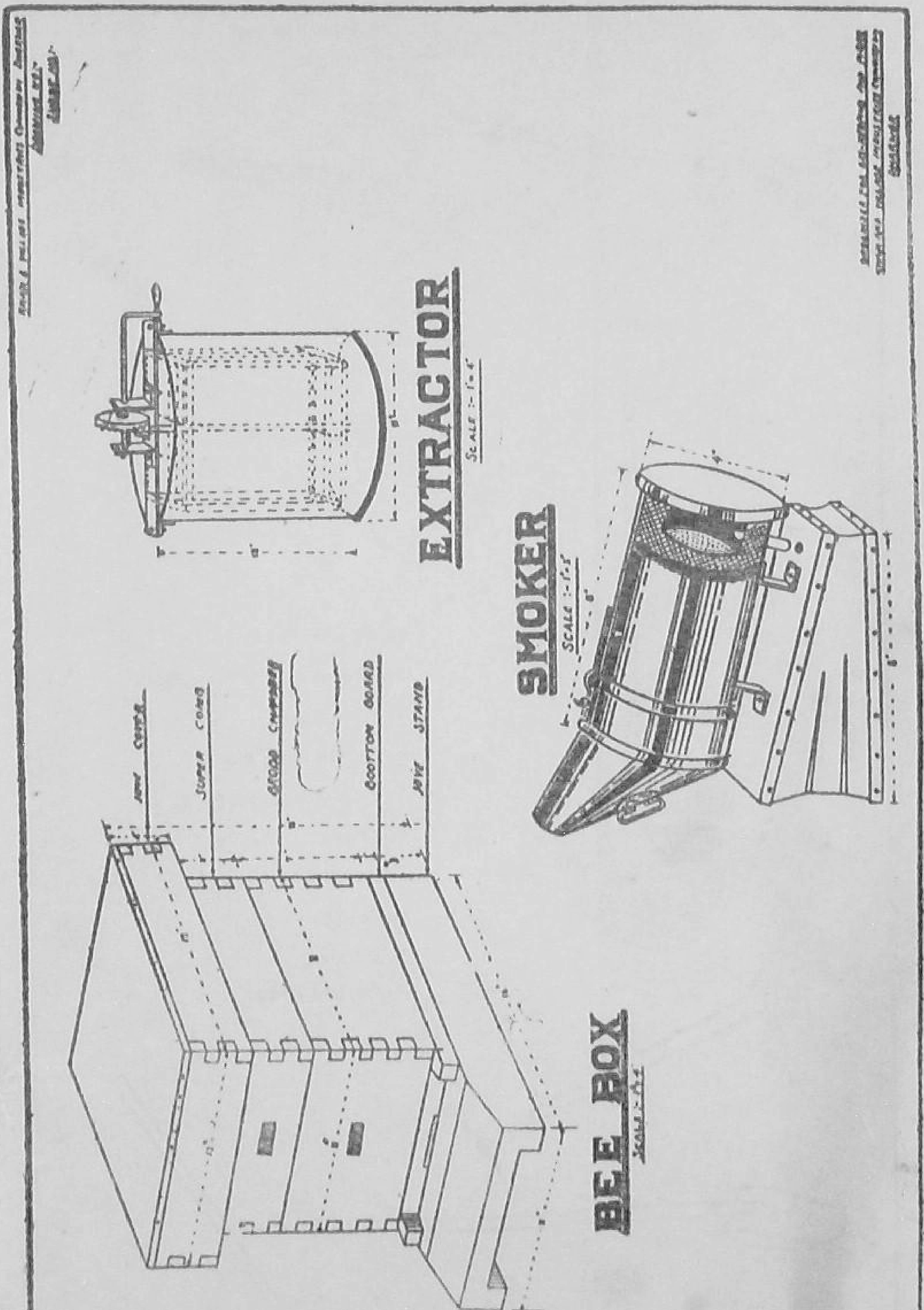

V.I.RESEARCH. INSTITUTE WARDHA.
NEEM FRUIT DEPULPER-CUM-GROUND NUT DECORTICATOR.
COMPLETE — UNIT
FRONT ELEVATION
SIDE ELEVATION
COMPLETE — UNIT
FRONT ELEVATION
SIDE ELEVATION
Groove for catch
Agitation cylinder
Wedge cock
Wooden handle
AGITATOR VANES IN DETAIL
FRONT ELEVATION
SIDE ELEVATION
AGITATION CYLINDER
Wooden base
Agitator vanes, wooden
Screw
SIDE ELEVATION
PLAN
Agitator
Slit for seed dropping
Ball bearing
SIDE VIEW OF AGITATOR
SCALE ⅛ FULL SIZE
MAGAN WADI
WARDHA



9. Village oil Industry and Soap Making

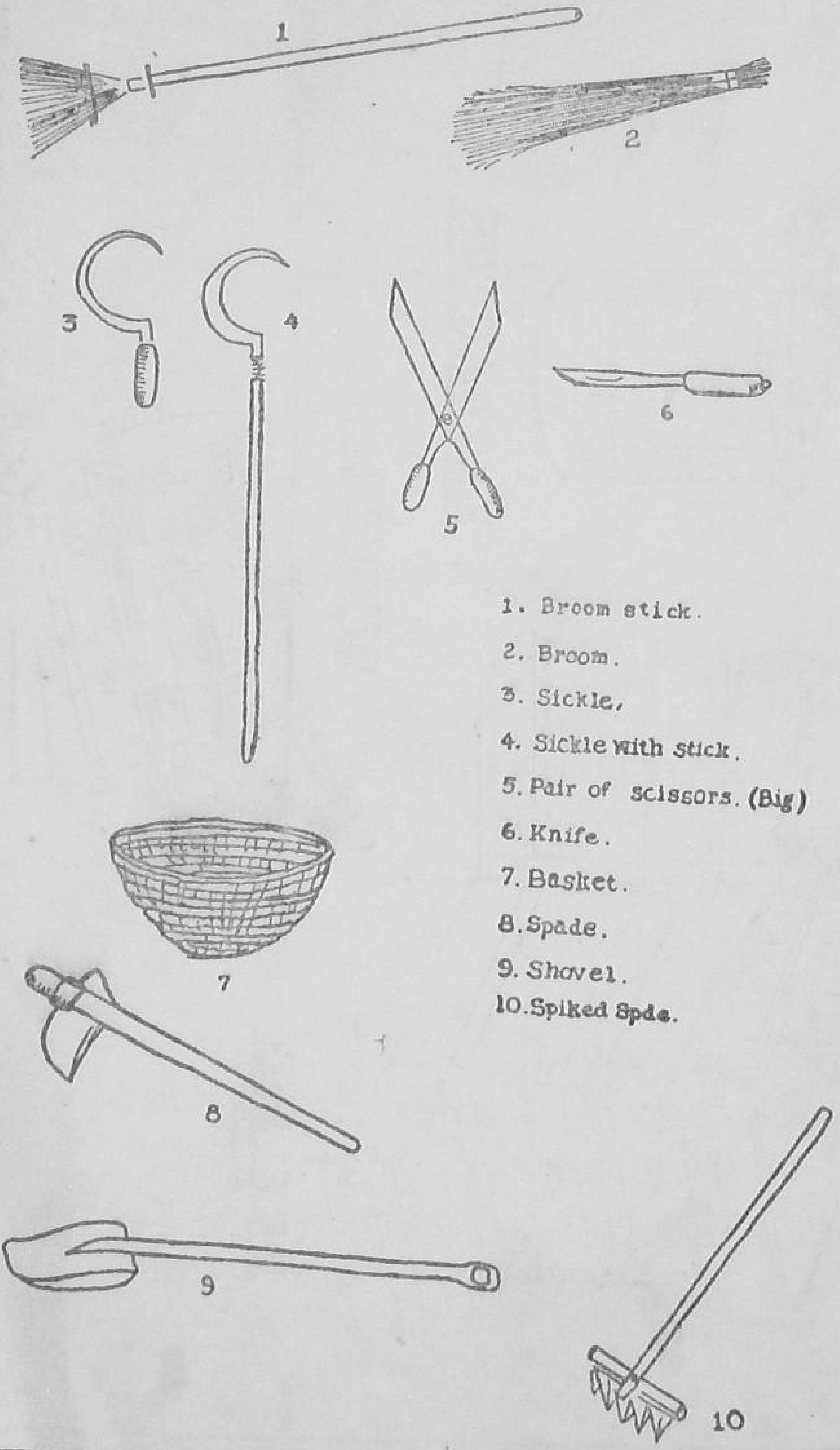


MAIN BODY FRONT VIEW HALF SECTIONAL
MAIN BODY - PLAN
LAT ELEVATION
LAT PLAN
MANKDI
BIG HINGE
SMALL HINGE
BOZA PAT - FRONT VIEW
BOZA PAT - PLAN
REPLACABLE PHACHER CUT INTO 6 EQUAL PARTS WITH 6" DIA PLUG IN CENTRE
ALL INDIA KHADI & VILLAGE INDUSTRIES BOARD
VILLAGE OIL INDUSTRIES
IMPROVED OIL GHANI
-: MODEL KVB-57 :-
-: DETAILS :-
(1) MAIN BODY
(2) BOZA PAT
(3) LAT
(4) MANKDI
(5) BIG HINGE
(6) SMALL HINGE
(7) PHACHER (DETAILS)



5. Bee keeping

IMPLEMENTS USED IN THE COLLECTION OF NON-EDIBLE OILSEEDS.



1. Broom stick.
2. Broom.
3. Sickle,
4. Sickle with stick.
5. Pair of scissors. (Big)
6. Knife.
7. Basket.
8. Spade.
9. Shovel.
10. Spiked Spde.

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